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CONTENTS

The 'Spark Plan' and Rural Energy Construction

916B0089C Beijing JINGJI RIBAO in Chinese 20 Jun 91 p 2

[Article by JINGJI RIBAO reporter Zhang Zichen [1728 1311 5256]: "'Oxygen' Is Needed To Set the Prairie Ablaze—Development of China's Rural Energy Resource Construction and Countermeasures"]

[Text]

I. It's Like the Ministers Said

Many ministers have "expounded a righteous cause" regarding rural energy resource construction. As the Ministry of Forestry minister said, China now consumes about 330 million cubic meters of forest a year, about one-third of it burnt in rural areas (including township and town enterprises) annually. Thus, focusing on rural energy resource construction is the same as focusing on forestry. The Ministry of Public Health minister said that the main cause of death in the rural population at present is respiratory tract infections and that the smoke from fires due to the burning of firewood causes major damage to the respiratory tracts of peasants. Thus, developing biogas is the same as bringing prosperity to the peasants. Leading comrades in the Ministry of Construction say that China's rural population will reach 1 billion by the end of this century. If China's people are to attain a relatively prosperous living standard, we must achieve a basic solution of the problem of rural energy resources.

II. The Threat Is Before Us

In the early 1980's, the amounts of coal, oil, and electricity commodity energy resources used in China's rural areas accounted for 20.6 percent of total energy consumption in our rural areas. At present, 20 percent of China's peasant households have no electricity and the yearly per capita energy consumption is just 0.42 tons of standard coal. Peasant households have shortages of household fuels for an average of 3 months a year. For a long time, large numbers of peasants and pastoralists have been forced to search for burnable material, which has caused destruction of natural vegetation over a large area throughout China as well as water loss and soil erosion, land desertification, and an abrupt reduction in organic matter in the soil.

As China's economy develops, over 80 percent of our ever-growing industrial wastes are transferred untreated to rural areas, which has created an extreme threat to our agricultural production environment. Farmland suffering from varying degrees of pollution has reached 6.7 million hectares, which is causing a reduction of more than 10 billion kg in grain output each year, and the economic losses to aquaculture exceed 300 million yuan. Finding ways to solve the rural energy resource and environmental pollution problems are needed to ensure development reserve strengths for agricultural production and to promote construction of the two types of civilization [material and spiritual] in rural areas and develop our entire national economy.

III. The Solution Stands Before Us

Rural energy resources cannot rely entirely on the commodity energy resources supplied by the state, which are coal, oil, and electricity. Similarly, neither can the rural environment simply rely on large investments by the state for improvement. This is determined by China's national conditions. Over the past 10 years, China has implemented the principles of "adapting to local conditions, using multiple energy resources for mutual compensation, comprehensive utilization, and concern for results" and "a combined focus on development and conservation, placing energy conservation in the vanguard position in the near term". Our vast rural areas have made major efforts to extend firewood and coal conserving technology, active and stable development of biogas, developing and utilizing solar energy, wind energy, geothermal energy, and other routes to reinforce management of rural production and energy conservation. They have formed a capacity for conserving and producing an additional 30 million tons of standard coal each year and they have increased the benefits of energy resource utilization and made partial improvements in the environment. It would be appropriate to say that rural energy resource construction in China has taken a successful route that has generated enormous social and economic benefits.

There are 4.7 million peasant households using biogas and their methane pits are consuming all of the human and animal wastes of these peasant households. They can supply over 30 million tons of superior quality methane fertilizer for farmland that is equivalent to over 800,000 tons of ammonia, phosphate, and potassium fertilizer. They have used organic wastes from distilleries, livestock yards, slaughterhouses, and other enterprises to build over 1,500 biogas supply stations that process 1.4 million tons of waste water each year and provide commercial biogas via pipeline to over 50,000 rural residents. They include more than 200 technologically advanced large and medium-sized biogas projects (with daily gas output of 50 to 5,000 cubic meters).

This sort of miracle can be seen in the Xihu [West Lake] region of Hangzhou: a large hog and poultry breeding ground as one enters Xishan Village. It is like walking into a large flower garden where one smells the fragrance of flowers. The grounds and buildings and large fish raising ponds which produce 5,000 hogs and 150,000 chickens and ducks a year have been concealed behind sweet-scented osmanthus, roses, Chinese sweet gum trees, masson pines, oriental arborvitae, and grape trellises.

In the past, the severely polluted Hangzhou environment was renowned for being one where "foul gases filled the sky on sunny days and rainfall filled pits with liquid excrement". The appearance of this miracle today is due to the contributions of biogas projects. While providing pipeline gas supplies for all of the village's 178 households, the biogas is also used in production realms like baking and processing tea, warming poultry coops, and so on.

Over 110 million peasant households are using firewood and coal-saving cooking stoves that provide fuel savings of

more than one-third compared to conventional stoves. The clean and sanitary new cooking stoves have removed over 100 million rural women from the hardships of "smoky fires" and the extension of firewood and coal conservation technology in rural areas has already formed a yearly conservation capacity equivalent to about 26 million tons of standard coal. This includes about 1 million tons in large industrial users of energy in rural areas. Ningbo indicates that if the entire city were to extend energy conserving technology like that used for baking tea at Yinxian County's Fuquanshan tea plantation and others, the amount of wood conserved each year would be equivalent to afforesting 12,800 mu of hillsides. One of the measures Guangdong used to become "the number-one afforestation province" is extending firewood and coal-conserving cooking stoves.

Generating electricity via small-scale hydropower and wind power and the utilization of natural gas and solar energy have brought vitality to the lives and production of people in frontier, island, and poor mountainous regions. Over 2.3 million peasant households are using electric stoves and natural gas. Some areas in Xinjiang are using solar stoves as "dowries" when young women get married. An old peasant in a village on the top of a high mountain at Rui'an in Wenzhou said that using micro-scale hydropower to generate electricity enabled them to spend their first Spring Festival illuminated by electric lights. One day early in 1991, men, women, the young, and the old all went down the mountain ahead of time to welcome a comrade from the provincial rural energy resource office and there was a continual sound of firecrackers along the way. Their gratitude for the concern of the party and government were moving.

A definite foundation has been laid for future rural energy resource construction, technical levels are becoming ever more mature, industry and service systems have developed substantially, and many skilled technical and administrative personnel have come to the fore. During the process of research and extension, many new technologies have distinguished themselves in realms of production and life. Examples include using biogas to preserve fruit, preserve grain, and kill insects. Biogas liquid is being used for immersing seeds, raising hogs, comprehensive biogas utilization projects at livestock yards, solar energy drying technology, micro-scale hydropower electricity generation, animal-powered electricity generation, and many more types of energy conservation technology. This is especially true of 12 different county-level trial points in different regions that have passed state examination and acceptance that have provided successful models for comprehensive development of rural energy resources in the future.

III. "Oxygen" Is Needed To Set the Prairie Ablaze

Summarizing China's achievements in rural energy resource construction over the past 10 years shows that they are multi-faceted and that this is merely an excellent beginning. Because there is not enough of the startup and support capital needed, and in combination with the inadequate understanding of leaders and policymaking departments in some locations, there is still no balance in development levels in rural energy resource activities. Now, these activities which will benefit the present age and a thousand years to come urgently await a spark to set the prairie ablaze. Like adding "oxygen", there should be an appropriate increase in support capital and the materials required should be included in state plans. Many experts have pointed out that if the state could maintain the level of investment in these projects during the Seventh 5-Year Plan that it did in the Sixth 5-Year Plan, the route to rural energy resource construction in China could be made even broader. Apparently, the state allocated 3.8 million yuan in capital each year during the Seventh 5-Year Plan (an average of less than 2,000 yuan per county (city)). Of this amount, just 800,000 yuan went to biogas construction. This is just 10 percent of the 8 million yuan allocated to biogas activity funds each year during the Sixth 5-Year Plan. Moreover, the required steel, wood, and other materials depended entirely on negotiated prices for purchases, which exacerbated the capital shortage. Of course, it would be quite difficult to rely entirely on the state to provide the capital and there is still much that can be done by local government. Officials in the Zhejiang Rural Energy Resource Office stated that 300,000 peasant households and 40 townships in Zhejiang have no electricity supplies and that the problem could be solved by allocating 1 million yuan in capital, so buying a few less cars would be sufficient.

Sustained Development of Power Industry Through Scientific Advances

916B0086A Beijing ZHONGGUO NENGYUAN [ENERGY OF CHINA] in Chinese No 7, 25 Jul 91 pp 1-6

[Article by Vice Minister Lu Youmei, Ministry of Energy Resources]

[Excerpt]

II. Ten-Year Targets for the Advancement of Science and Technology in the Electric Power Industry, and the Mission of the Eighth 5-Year Plan

To meet the target of quadrupling the 1980 national GVIO by century's end, the electric power industry will have to reach an installed capacity of 240 million kW, its generating capacity will have to be 1.2 trillion kWh per year, and the technology level in primary technical areas will have to be at the early 1980's world level. The targets set to meet this overall program are as follows:

What will be sought after in developing thermoelectric S&T is the application of high-parameter, high-capacity thermoelectric units; the up-scaling of the large 200,000 and 300,000 kW units that are now being produced in-country; solving, as quickly as possible, the problems of improving the design and domestic production of imported 300,000 and 600,000 kW units; mastering the technology for air-cooled condensers and low-polluting fluidized combustion technology; and solving the technological problems of the use and conservation of water by power plants, the transportation of coal, discharge of ash, and prevention of environmental pollution. Advanced

applicable-technology standards must be formulated and used, there must be improved plant design and installation technology, lower building costs, shorter construction time, greater use of computer-assisted design, implementation of computer-integrated project management, advanced operation and maintenance technology, and higher operating safety and economy. By the end of this century the ratio of coal consumption to energy output at thermoelectric plants throughout the country should be reduced to 380 grams per kWh, the unit utilization rate should reach 78 percent; at power plants that use cooling towers the consumption of water per 1 million kW capacity should be reduced to 1 ton per second; after the 1990s, the utilization rate, coal consumption, and load tolerance of domestically produced 300,000 and 600,000 kW units should reach the early 1980's level for foreign units of the same type; and the environmental impact of newly constructed power plants should be below present legal requirements. The technology for utilizing supercritical units, ultra-supercritical units, single units of capacity up to 1 million kW, and gasified coal combined-cycle power generator technology should be at hand.

In the development of hydropower S&T, the use of advanced technology to improve programming of hydropower survey and design, the management of engineering operations, the layout of functionally coordinated arrangements of large- and medium-scale main power stations, the capacity of old hydropower stations, functional reforms, and key technologies for pumped-storage power stations, must be improved. The development of geophysical prospecting, remote sensing, applied satellite technology, modern survey programming technology and reduced construction time, must all be accomplished. To design dams over 200 meters high, and undertake large-scale underground engineering projects, key technologies for engineering and large-scale construction equipment and facilities must be mastered. Research must be done to develop new hydraulic turbines with high volume-to-speed capacities of 500,000 to 700,000 kW, and the technology for flow-through units and hydraulic turbine units must be mastered. Projects should be completed more quickly. By century's end, a time period of 3 years for hydropower project survey and design should be assured; for large-scale projects it should not exceed 5 years; a period of 5 to 6 years from start of construction to start-up of the first generator unit should become routine; medium-scale hydropower projects should take about 3 years. The technologies requisite for construction of hydropower stations on a huge scale, and high-head large-capacity pumped-storage units should be at hand.

In the development of nuclear power stations, key concerns center around installations, debugging, operational and personnel training, and active attention to coordination of operations.

In the development of S&T for power networks, improvements should be made in the circuitry design and construction technology of 500,000 volt transmission and transformer facilities, 500,000 volt DC transmission technology should be mastered, new types of overvoltage-threshold technology should be researched, and on-line monitoring technology for power transmission and transformer facilities should be improved. Research should be done on urban and rural power supply and consumption technology; and load control, storage capacity, and peak-load modulation techniques, dedicated telecommunications systems for power grids, and computerized information systems should be built. By the end of the century tiered data acquisition, and inspection and control systems to meet power grid modulation requirements; telephone, data, fax, and image information systems for an integrated digital communications network, power grids with electric current cycles of up to 50+/-0.1 Hertz, and main urban subscriber voltages that meet the requirements of the "National Power Supply and Consumption Rules and Regulations" should be developed. Technology for 1 million volt extra-high voltage power transmission, and technical facilities for a national integrated power network should be developed.

1. Organizing Technology Attack for Major Projects

An S&T attack should be launched centering around the key technological questions of construction engineering and production of electric power. A 3-level approach should be set up. First, a national level approach to enter projects into the national Eighth 5-Year S&T attack plan is needed. Initial steps that will be taken are: research on key technology for construction of dams over 200 meters high, research on key technologies for pumped-storage capability, and trial manufacturing of such large-scale equipment as: the anticipated key engineering facilities for the Three Gorges water conservancy project, large-scale hydropower facilities like the 300,000 and 600,000 kW thermoelectric units, and 500,000 volt AC power transmission and transformer complete-package facilities. Second, a ministry level attack to enter projects into the Ministry's key S&T attack plan must be effected. These projects will be prioritized according to the prevalence of key technical problems they present and the importance of their role in the advancement of technology throughout the industry. The Ministry has already organized and formulated a (draft) S&T attack plan for the electric power industry's Eighth 5-Year Plan, and has defined 36 projects with a total of 216 topics of study. Third, the S&T plans of the Provincial Bureaus of networks are mainly intended to solve major S&T problems locally within the Provinces of a network, and to generate technological advanced services for enterprises.

To realize long-range electric power S&T development targets, to follow the development of the latest world electric power technology, the Ministry will organize and arrange a list of internationally advanced technologies of high difficulty to be held in a reserve status for later attention to the benefits they may have for the future development of the electric power industry.

The Ministry must avoid and reduce duplication in S&T projects. Those scientists and technicians who will be participating in major industrial S&T projects may be granted subsidies as stipulated under subsidies set aside for national S&T project positions.

2. Developing New Technology, Making Wide Use of S&T Achievements

Making use of new technology and disseminating S&T results are important links in turning S&T into production strength. It is putting into action the latent capacity idea that was surfaced at the All China Energy Work Conference. To do this, the S&T units and production and construction enterprises must be closely united, must arrange for scientists and technicians to share their achievements, and in doing so they must look upon the demonstration of the totality of their technology and the sharing of their exemplary work as the culmination of their responsibilities. The production, engineering and construction enterprises must combine technology reforms with the use of new technology and with their S&T achievements. Design units must introduce their mature and applicable new technologies into engineering and construction, and quickly integrate them into the operating rules and standards. The various level administrative organizations of the electric power industry should set up an administrative system and assign specialists to be responsible for the task of dissemination. The ministry should open up a technology market, and set up an S&T end product information network for coordination. To strengthen application of new technology a (draft) plan for disseminating new electric power technology should be drawn up for the Eighth 5-Year Plan. Its first increment should include 100 dissemination items consisting of trial-manufactured S&T attack items, technical development items, and new product items, all of which should be well advanced, mature, applicable, and economically profitable technologies with promising social benefit. This plan will be instructional for the entire electric power industry. The various provincial bureaus and departments of the networks involved with design, engineering, and production should formulate plans for new technology dissemination items as are appropriate to their respective areas. The ministry must organize and coordinate efforts to step up exchange of information on S&T achievements, and open up technology markets.

Enterprises must be encouraged to put new technology to use, and any technology takeover fees incurred may be listed under costs. After adopting a new technology, it is permissible to take a set amount of award funds for S&T end product dissemination out of the increased profits that have been earned by using the new technology. The Ministry should establish new technology dissemination awards for ad hoc citations to units and individuals who have made outstanding contributions in dissemination work.

3. Technology Reform for Viable Enterprises

By century's end, energy and water consumption must be reduced, generator unit utilization rates must be increased, environmental pollution controls must be improved, and electric power quality must be guaranteed. While there are facilities of high technological capability available for new construction and engineering, for the most part, emphasis must still be placed on renovation of old facilities. The Eighth 5-Year Plan must resolve to take technological reform as the main course to advancing technology. In addition to supplying completely outfitted electric facilities to eliminate shortcomings and perfect reforms, there must also be use of mature and applicable new technologies, new facilities, and new materials. In order to have great improvement of economic performance in existing facilities, power plant and power network safety must be raised, the ratio of power output to coal consumption of thermoelectric plants must be lowered each year by 3-5 grams per kWh.

In accordance with the "National and Enterprise Technology Advancement Incentive Awards Law", the Ministry of Energy Resources will establish a Ministry of Energy Resources electric power enterprises technology advancement award. Technological advancement must be taken on as an enterprise goal, and as one of the country's first class enterprises, the industry must become a model of excellence in technological advancement.

There must be further development of group technology reforms and mechanisms for practical suggestions.

4. Increase International S&T Cooperation and Exchange; Imported Technology Must Be Properly Digested and Absorbed

Increasing international S&T cooperation and exchange is the catalyst for the development of China's electric power S&T and modernization. The establishment of international S&T cooperation and exchange projects must be continued in concert with developmental targets and missions. Teams must be sent out to examine the technologies in specialized fields, and they must attend international S&T and academic conferences. They must quickly familiarize themselves with the latest new international S&T information, and must make full use of international grants and loans. S&T specialists should be sent out, and others should be invited to participate in meaningful S&T cooperation. There must be support for major scientific research units and specialized fields to establish lasting cooperative relationships with counterpart international organizations. The study and mastery of the technology of imported large-scale facilities should be intrinsic with technology trade. The building and restructuring of enterprises should be done for the purpose of introducing new products and stimulating foreign cooperation. Scientists and technicians must be sent out for advanced studies, and conditions for making use of their talents should be created. Attention must be paid to ingestion and absorption of imported technology with emphasis on ultimate domestic production and enhanced self-development capabilities, and activities should be directed toward organically fusing international S&T cooperation with S&T attack and with technical development.

5. Increase Technical Supervision

Technical supervision is an important part of S&T activity, and has an important role to play in technological advancement. The electric power industry is a technology-intensive industry, and increased technical supervision is very important.

Technical supervision must be standardized with metrology as its base and quality as its soul. The "Law of Standardization" must be rigorously enforced. For 2 years the Ministry examined over 550 items and it has set down measures for the overhaul of industrial standards to bring the S&T situation up to the times. Furthermore, in its desire to meet requirements for developing the electric power industry, it worked out a national and industrial standards formulation program for the Eighth 5-Year Plan. At the same time, standards must be established and adjusted in the committees of specialized fields for a sound electric power standardization system, and to bring industrial standards gradually into line with national standards.

Metrology is a basic activity of the electric power industry. In accordance with the "Measurements Law" it must continue to amplify its standard measurement value transfer system, and implement legal units of measurement throughout. Technical supervision in heating, chemistry, insulation, and metallurgy must be strengthened to effect and upgrade measurement validation of units of measure used by enterprises. Use of national measurement standards must be firmed up. Quality control and quality supervision must be greatly improved. Quality control and quality supervision must rely on metrology. The good quality attainments of this year should become the starting point for strengthening quality control in the Eighth 5-Year Plan. All that has been good and bad in quality control in electric power design, engineering, and production should be taken into consideration in the upgrading and the goal- oriented actions in the industry. There must be further adjustment, and perfection in quality inspections in special fields, and quality supervision of functional inspections and product licensing should be strengthened.

6. Continue To Perfect and Intensify Reforms in the S&T Organizational System

There are more than 17,000 employees in the individual scientific research and testing units of the electric power system. Among these units there are 7,487 individuals in electric power academies and research institutes that are directly subordinate to the Ministry. Scientists and technicians make up 71 percent. This is a real S&T research force, and it is an S&T experimental force that is accomplished both in theory and in practical experience. It is the main force for technical progress in the electric power industry. China must pass continued reforms to perfect and intensify change in the S&T organizational system. The activism of this S&T force and of all who are involved in electric power industry engineering technology must be aroused and mobilized, and they must be prevailed upon to pursue the S&T attack, development, dissemination, reforms, and digestion and absorption of imported technology.

In the Eighth 5-Year Plan the responsibility system of academy and institute leaders, the project contract system, the chief engineers of the large and middle-sized enterprises, and various control systems should be perfected. Compensation for takeover of S&T end-products should be continued, technology markets should be opened up, and there should be continued encouragement of independent developmental scientific research units to be economically self-supporting and to exercise their rights to act on their own.

At the same time that the S&T system reforms are being intensified, the various policies and regulations of the S&T reforms should be definitive to resolve conflicts that arise from the S&T reforms, and to overcome the abuses that arise therefrom. As to the independent scientific research units, they must overcome conflicts of current and long-range actions, they must put technology reserves in position of primary importance, handle adverse relationships, and give priority to completion of national and business command plans; they must overcome the conflicts between accumulated and assigned actions, increase their self-help in establishing and maintaining logistics; they must resolve the conflicts between first-line and second-line scientific research, and make it clear that second-line research supports the first-line research. Organizational redundancy in the specialized fields must be rectified and adjusted, and full use must be made of scientific research academies and institutes, and scientists and technicians.

In carrying through the intensifying of reforms in the S&T organizational structure, the scientific research academies and institutes must be further invigorated, the activism of their staffs and workers must be invigorated. Organization of scientific research units should be simplified, teams must be skilled, scientific research should be foremost, and many kinds of engagements must be initiated. People from outside the specialties should be organized to shoulder the logistical work, the manufacture of new products and the third-line output so as to lessen the load and increase the economic vitality of scientific research academies and institutes. The independent scientific research units that are forming up may eventually form technical industrial trade groups. Specialists have a special leadership role, and must work in scientific research units that are suitable for self development.

The various electric power academies and institutes, under the full examination and guidance of their party committees, must strengthen their thought and political work, and resolutely resist the influences of the capitalist class; they must oppose the view that "money is everything", and bravely climb the heights of S&T, and politically cherish the socialist fatherland. They must conscientiously dedicate themselves to the S&T forces of China's electric power industry.

7. Further Strengthen and Perfect the Support and Service System for S&T Progress in the Electric Power Industry

Intelligence, information, learned societies and associations, publications, etc. are all germane to the building up of electric power S&T, and must be given full attention. Research in S&T intelligence must be increased. There must be rapid accumulation and transmission of the newest international electric power S&T information, and the electric power intelligence network must be accessed, and the S&T information exchange within the electric

power industry must be successfully accomplished. S&T information focused on major S&T attack fields and major fields of inquiry on which government policy decisions are pending should be pursued as a separate activity, and relevant consultation services should be provided. Energy resource industry information storage and computerized global scientific information search and exchange services must be perfected, S&T achievement funding must be strengthened. Financial foundations outside of S&T must be found. Energy resource information control systems must be used, and S&T intelligence work must be modernized and improved.

Support for business societies and associations must be improved, and technical development services must be organized, S&T team staff officers and assistants must be made use of, and S&T exchange and consultation services must be broadened.

The publication of electric power industry S&T books and periodicals with better quality and social effectiveness must be continued, policy decisions for electric power industry's production and construction that are broad in outlook must be made, and electric power S&T knowledge services must be popularized.

The material conditions for control of S&T resources and construction of S&T units must be well handled.

China Thirsty for More Fuel to Power Industries

40100002A Beijing CHINA DAILY (Opinion) in English 7 Oct 91 p 4

[Text] Energy shortages are likely to hinder China's development in the future unless energy use is improved, said a report in SCIENCE AND TECHNOLOGY DAILY (September 20).

While China boasts proven coal reserves of more than 900 billion tons and the richest hydropower resources in the world, the fuel shortage is a serious problem which has long troubled industrial leaders.

Some industrial enterprises are forced to run at half capacity and others stay idle for days when electricity consumption is at its peak.

It is estimated that industrial firms get no more than 95 percent of the energy they need each year.

The nation's energy resources fall short by about 10 million tons of crude oil and 19 million kilowatts of electricity a year.

The irrational pattern of energy production and consumption is a major cause of the shortages, said experts in interviews with SCIENCE AND TECHNOLOGY DAILY. So far, the nation has tapped no more than 9.2 percent of its hydro-electric resources.

Experts point out that coal has remained the country's most common fuel. But the huge consumption of raw coal has led to environmental pollution and put enormous strains on the transportation industry.

Problems related to coal production have further worsened the country's fuel shortage, experts commented. According to the report, State-owned coal mines turn out only 45 percent of the country's annual coal output. Collectively-run and private coal mines produce 34.5 percent of the total output, and individuals are responsible for the rest.

Coal Reserves

Managers of private coal mines are likely to stop production after they make enough money and, as a result, coal production has been erratic.

Also, during the past decade, only 17 percent of the coal has been washed, affecting quality badly.

The report said that known coal reserves in many State-owned pits will be exhausted in the next few years, and warned that coal production will decline.

Meanwhile, the report presented a gloomy picture of the country's oil production.

Few new oil fields have been found in recent years to replace the existing ones, some of which are almost completely drained.

Since the government has not significantly increased its investment in the energy industry in recent years, the development of power plants has slowed.

And the generating capacity in most power plants is very small, thus making the use of oil, coal and other energy sources less efficient.

Energy prices, though they have been raised several times during the last few years, remain unreasonably low and prevent the energy industry from expanding, said the report.

More worrying is the serious waste of energy, the report quoted experts as saying.

Too many industrial firms are still armed with outdated facilities which consume large amounts of energy and produce high levels of pollution.

In rural areas in North China people usually burn raw coal for heating in winter, squandering large quantities of coal. It is calculated that on average, about 300 million tons of coal are wasted each year.

Energy Consumption

While China's total energy consumption is far below that of developed countries, policy-makers will have to give priority to tackling the country's energy shortage in the coming years, said the experts.

The government should invest more money in the energy industry, and ask industrial firms to update their technology.

Meanwhile, energy saving technology research should be strengthened and new findings should be expanded on a large scale.

Current fuel prices should be further adjusted in a bid to encourage managers to develop the energy industry.

The nation will have to make more efforts to exploit its abundant hydropower resources, and boost thermal and nuclear power.

The construction of State-owned coal mines should be accelerated, and the management of collectively-run, private coal mines should be looked at closely.

Farmers should be asked to reduce consumption of raw coal, and electricity should be more widely used in rural areas, the report concluded.

Southwest Energy Base Moves Toward Second Great Expansion Period

916B0089A Beijing RENMIN RIBAO HAIWAI BAN in Chinese 5 Aug 91 p 1

[Article by reporter Xi Nan [1153 2809]: "Southwest China Welcomes Second Large-Scale Development, Investments To Reach Several 10 Billion Yuan, Scale No Smaller Than 1960's, Region To Become China's Main Energy Resource and Raw Materials Base Area"]

[Text] As we enter the 1990's, the southwest China region is welcoming a golden era of its second large-scale development.

Information indicates that the total investment in all the key engineering projects in Sichuan, Yunnan, and Guizhou provinces that will begin construction during the Eighth 5-Year Plan will reach several 10 billion yuan and that the overall construction scale during the 1990's will be no smaller than the first concentrated development of southwest China energy resources during the three-line construction period in the 1960's.

These three southwestern provinces account for one-sixth of China's total population and cover a total area of more than 1.1 million square kilometers. They are one of China's richest regions in energy resources. As we enter the 1990's, with a shift in the principle of economic construction in China from a regional emphasis to an industry emphasis, formal action will be taken on a new round of development plans to build the southwest China region into an important energy resource and raw materials base area in China.

Lakes will appear in the high mountains and new cities will be built on level land. Among the thousands of mountains, rivers, and streams in the large southwest China region, hydropower construction is now entering a stage of large-scale cascade development. Besides the large hydropower stations with installed generating capacities of more than 1,200MW now under construction at Manwan, Yantan, Tianshengqiao, and other places, more than 10 large power stations will be built on the Yalong Jiang, Jinsha Jiang, Lancang Jiang, and Wu Jiang during the 1990's. Apparently, the southwest China region accounts for more than one-half of the total scale of installed generating capacity now under construction throughout China. By the end of this century, the total scale of installed hydropower generating capacity built in the southwest China region will exceed 20,000MW, making it China's largest hydropower base area. At the same time, there will be a significant expansion in the construction scale of the Guizhou coal base area, the largest in south China. Over the next 10 years, its production capacity will be increased by nearly 50 percent and several pit-mouth power plants will be built.

In conjunction with this, construction of the ultra-high voltage power transmission line connecting the southwest China energy resource base area with the Guangdong, Hong Kong, and Macao region is being speeded up. The 500 kV Tian-Guang [Tianshengqiao-Guangzhou] ultra-high voltage power transmission line extending for a total length of 1,000 kilometers starting in the west at Tianshengqiao on the Guizhou-Guangxi border and running eastward to Foshan and Jiangmen in Guangdong will be opened and transmit power in 1992 and another line will be completed in 1997. During the last half of the 1990's, a third power transmission line will also be built. At that time, the abundant electric power of the southwest China region will flow unceasingly to eastern China via this "south China electric power corridor" running through lofty mountain peaks and provide a powerful motive force for an economic takeoff of the coastal region. The energy resource development deployment for "transmitting power from west to east China" that has been brewing for such a long time will become a reality.

Using energy resource base area construction as a tap, a large group of raw material industries and processing industries are rapidly emerging in southwest China. In Guizhou and Yunnan, which have more than 90 percent of China's phosphorous resources, there is a high tide of construction at China's two largest ground phosphate fertilizer and phosphate chemical industry base areas. After the first and second phases of the Wengfu ground phosphate fertilizer base area in Guizhou with an investment of 2.2 billion yuan are completed, it will form a 5.5 million ton phosphate ore and 800,000 ton heavy calcium yearly production scale, and Caopu, located in the suburbs of Kunming City in Yunnan Province, will become China's largest yellow phosphorous base area by the end of this century.

Of the state's 10 large non-ferrous metals projects to be built during the Eighth 5-Year Plan, three will be built in the southwest China region. By the end of this century, this region will be built into one of China's three large gold industry base areas.

10 Million KW in Installed Generating Capacity To Be Added in '91

916B0089D Beijing JINGJI RIBAO in Chinese 27 Jul 91 p 1

[Article by reporter Xie Ranhao [6200 3544 3185]: "Accelerate Electric Power Construction, Ensure Economic Development, 10,000 MW in New Installed Generating Capacity To Be Added in 1991"]

[Text] News arriving from electric power construction sites throughout China indicates that as a result of the acceleration of the pace of electric power construction, China will add 10,000MW in new large and medium-sized generators

per year for the first time during 1991 and 1992. The total capacity of the electric power generators placed into operation during 1991 and 1992, 20,000MW, will equal one-seventh of China's present total installed generating capacity of electric power equipment.

At a meeting to implement electric power operationalization tasks held in mid-July 91 at Shentou Power Plant in Shanxi, Ministry of Energy Resources vice minister Hu Fuguo [5170 1381 0948] stated while discussing the situation of electric power construction that is now being accelerated that this is needed to ensure the sustained, stable, and coordinated development of our national economy. He stressed that in order to increase the returns to investments, the electric power capital construction system must certainly give primacy to exploiting potential in enterprises and increasing labor productivity. Shortening construction schedules must be the breakthrough point in proper use of investments and improving the quality of construction must be placed in a prominent status.

While discussing the significance of accelerating electric power construction, Ministry of Energy Resources senior engineer Qin Zhongyi [4440 0022 0001] told reporters that 1991 is the 21st year of China's electric power shortage and that while there had been an improvement in the power shortage situation since the last half of 1989, it was a temporary one. The recent reappearance of an electric power shortage in Guangdong Province showed that as improvement and rectification proceeded and industrial and agricultural production were restored, the power shortage situation will continue to intensify. Regarding this, he pointed out that we must not miss an opportunity to push forward with electric power construction.

Information indicates that of the 10,000MW of large and medium-sized generators to be placed into operation throughout China during 1991, operationalization tasks arranged in state plans are 6,538.5MW, another 1,735.5MW has been carried over from 1990 to 1991, local and other operationalization projects are 510MW, operationalization projects outside of plans are 400MW, and load-bearing debugging projects are 2,300MW. A total of 72 generators will be placed into operation, 10 of them hydropower generators, 61 of them thermal power generators, and one a nuclear power generator.

Apparently, the Ministry of Energy Resources will soon issue and implement is "Provisional Stipulations Regarding Civilized Construction in Electric Power Construction".

Outlook Said Bright for Xinjiang Energy Development

916B0089B Beijing RENMIN RIBAO HAIWAI BAN in Chinese 6 Aug 91 p 3

[Article by reporter Li Shengjiang [2621 3932 3068]: "Impressive Prospects for Energy Resource Development in Xinjiang, an Important National Energy Resource Base Area Replacement Region, the State Has Invested Over 5 Billion Yuan Annually Over the Past Several Years"]

[Text] Xinjiang Uygur Autonomous Region has made major efforts to develop its oil, gas, and coal resources, and has made significant progress.

Xinjiang covers a vast territory with abundant resources. It covers one-sixth of China's total area and will be an important energy resource base area replacement region in China over the next decade and into the next century. Forecasts indicate that the region has one-fourth of China's oil resources and one-third of its gas resources, making it first in China. It leads China in projected coal reserves, with one-third of the total in China.

Xinjiang has made gratifying achievements in developing China's oil and gas resources. Over the past several years, the state has invested over 5 billion yuan each year in petroleum exploration and development.

Geological prospecting data indicate that the Tarim Basin is also China's largest petroliferous sedimentary basin. There are many large oil-bearing structures there. The Tazhong-1 [central Tarim] structure alone covers 8,200 square kilometers, more than three times as large as Daqing Oilfield. Moreover, a minimum of nine high-output oil and gas generating strata have been discovered in the Lunnan, Yingmaili, Donghetang, and other regions in the northern part of the basin and several exploratory wells have erupted with high output oil and gas flows. A basically outfitted development and production experiment region has now been completed at Lunnan with a daily output of crude oil in excess of 1,300 tons.

Ten petroliferous structural zones have been discovered in the Turpan Basin and oil wells with industrial value have been drilled in two structural zones that have proven China's first large Jurassic system oil deposit, the Shanshan [Piqan] oil deposit. Forecasts by the relevant experts indicate that over the next 5 years, a yearly production capacity of 4 million tons may be completed in this region.

Although the old oil province at Karamay Oilfield in Xinjiang's Junggar Basin has reached the mid and late periods of exploitation, exploration of the surrounding region and the Gurbantunggut Desert in the central part of the basin indicate that the golden age of production development in this region is yet to arrive.

In Xinjiang, the coal-bearing area above 2,000 meters alone covers more than 80,000 square kilometers. Over 800 large and small coal mines have already been built with an annual production capacity of nearly 20 million tons. Besides providing coal for its own use, Xinjiang is also selling its coking coal as far away as six nations of east Asia and the Hong Kong-Macao region.

Major S&T Items Related to Three Gorges Project Accepted

916B0091C Beijing SHUILI FADIAN [WATER POWER] in Chinese No 7, 12 Jul 91 p 39

[Article by Guo Shan [6753 1472] of the State Council Three Gorges Project Inspection Committee Office: "Projects To Attack Major Technical Research Items During Seventh 5-Year Plan for Chang Jiang Three Gorges Project Examined and Accepted"]

[Text] The State Planning Commission held a meeting in Beijing from 10 to 12 May 91 to examine and accept achievements in projects to attack key problems during the Seventh 5-Year Plan in "Major Scientific and Technical Research for the Chang Jiang Three Gorges Project". The examination and acceptance committee felt that these projects fully completed the tasks stipulated in the plan to attack key S&T problems during the Seventh 5-Year Plan and that they attained the examination objectives. They are an indicator of China's effectiveness and levels in conducting multi-disciplinary, multi-departmental, and comprehensive attacks on key scientific research problems related to construction of a large scale project, and abundant achievements were made.

The "Major Scientific and Technical Research for the Chang Jiang Three Gorges Project" was divided into seven topics: 1) Key technical research on silt and water-borne transport; 2) Research on major geological and earthquake questions; 3) Research on key technologies for hydraulic structures; 4) Research on key technologies for construction; 5) Research on the electric power system and key technologies; 6) Research on the ecological and environmental impact and countermeasures; 7) Research on the question of flood prevention and the comprehensive utilization benefits. The topics are divided into 45 special projects and 365 sub-topics. There are 386 institutions of higher education and survey, design, scientific research, and construction units involved in attacks on key scientific research problems and there are 3,164 S&T personnel directly involved in them. They focused on the entire river basin and major systems. They began with the need for a feasibility discussion concerning the Three Gorges project and arrangements in long-term plans for development of the national economy, applying advanced scientific theory, ideas, methods, and measures, conducting research that integrates disciplines and coordinates departments on several key and sensitive issues, and eventually provided a clear qualitative and quantitative conclusion that provides a scientific basis for macro policymaking concerning the Three Gorges project and plans for comprehensive control and development of the Chang Jiang basin.

Beginning in the last half of 1990, an inspection committee composed of experts provided opinions on inspection of achievements for the achievements in each sub-topic, special topic, and topic. Of the 45 special topics, some attained advanced international levels and some attained vanguard levels within China. For example, the project to attack key scientific research problems concerning "silt and water-borne transport" was based on "full sand model simulation laws" and "non-equilibrium sand transport theory" that were created by Chinese scholars and made a contribution to the development of world silt science. In another example, during the process of attacking a key scientific research problem, they also obtained a great deal of reliable basic data that has been compiled and published as well as a large group of charts, collections of charts, articles, and data that has been compiled and will be published. These basic data and research achievements are extremely valuable scientific reserves for the state that will have long-term preservation value.

Accelerating Development of Middle, Lower Reaches of Lancang Jiang

916B0091B Beijing SHUILI FADIAN [WATER POWER] in Chinese No 7, 12 Jul 91 p 8

[Article by Zhang Jianxian [1728 1696 6343] of the State Energy Resource Investment Company: "A Major Step in Accelerating Development of Hydropower on the Middle and Lower Reaches of the Lancang Jiang"]

[Text] From 21 to 30 Apr 91, vice minister Lu Youmei [7120 0147 2812] of the Ministry of Energy Resources, State Energy Resource Investment Company general manager Yao Zhenyan [1202 2182 3508], Guangdong Provincial vice governor Kuang Ji [0562 0679], and Yunnan Provincial vice governor Li Shuji [2621 2885 1015] led comrades from all relevant departments on an inspection of Manwan Hydropower Station (installed generating capacity 1,500MW) now under construction on the middle and lower reaches segment of the Lancang Jiang, and they inspected the dam sites for three major cascade power stations, Xiaowan Hydropower Station (installed generating capacity 4,200MW), Dazhaoshan Hydropower Station (installed generating capacity 1,260MW), and Nuozhadu Hydropower Station (installed generating capacity 4,500MW). They also discussed the joint investment development, accelerating preparatory work, and other related question and measures and signed a cooperative development agreement. They decided to accelerate construction of Manwan Hydropower Station and to strive to place the first generator (250MW) into operation by the end of 1992. Moreover, the agreement also determined that Xiaowan Hydropower Station will be built via a joint investment by Guangdong Province, the State Energy Resource Investment Company, and Yunnan Province. The proportions of the investment will be 60 percent for Guangdong Province, 30 percent for the State Energy Resource Investment Company, and 10 percent by Yunnan Province. Dazhaoshan Hydropower Station will be built by a joint investment with the State Energy Resource Company investing 60 percent and Yunnan Province 40 percent. Nuozhadu Hydropower Station will continue the joint investment development in the cooperative arrangement used for Xiaowan Hydropower Station. Each of the parties in the joint investment will have property rights and divide the power and benefits according to the proportions invested in each power station. The portion belonging to the State Energy Resource Investment Company will be owned by the state and it has

decided to make an application to the state to strive to begin construction of Dazhaoshan Hydropower Station in 1993 and to place most of the generators into operation before the year 2000, to begin construction on Xiaowan Hydropower Station during the first part of the Ninth 5-Year Plan, to begin construction of Nuozhadu Hydropower Station during the later phases of construction at Xiaowan Hydropower Station, and to basically complete the three power stations within 15 to 20 years. To accelerate preparatory work, the agreement determines that Guangdong Province will provide 35 percent and Yunnan Province will provide 15 percent of the survey and design funds for Xiaowan Hydropower Station over the next 5 years (Guangdong Province has already provided over 4 million yuan in preliminary funds from 1989 to 1991) to compensate for insufficient state funds and to ensure that the preliminary design is completed in 1995 and that construction begins immediately.

The signing of this agreement is a major step in accelerating development of hydropower on the Lancang Jiang and it is a new model for using the socialist ownership system as a foundation for using a shareholding system to build hydropower stations during extensive reform.

The middle and lower reaches segment of the Lancang Jiang is one of the "hydropower motherlodes" with the best hydraulic resources and development conditions among China's 12 hydropower base areas. According to plans that have already been examined and approved, this section has been divided into eight cascades for development and will have a total installed generating capacity of 14,310MW and long-term average yearly power output of 72.176 billion kWh, and it will have the Xiaowan reservoir with a total reservoir capacity of 14.5 billion m^3 and the 22.3 billion m^3 Nuozhadu reservoir as perennial regulation key and downstream counter regulation reservoirs. The state and Yunnan Province have already agreed on a joint investment for Manwan Hydropower Station now under construction and three hydropower stations whose construction has been planned in the above mentioned agreement, including Xiaowan and the others. They will have a total installed generating capacity of 10,460MW, over 80 percent of the total capacity planned for this segment of the river. They will be four key cascade power stations. These hydropower stations are located in high mountain gorges and their topographic and geological conditions are both excellent for construction of high dams. They will have good reservoir regulation capabilities and high guaranteed output, they will inundate little cultivated land and require resettlement of few people, generate large amounts of power that is also of high quality, and have superior economic indices, so the benefits are quite apparent. Given the enormous scale of the projects and large amount of the investment required, however, as well as the need for an enormous market for selling the electric power, a joint investment development arrangement was adopted that can closely integrate resources with the electric power market, use the advantageous and avoid the disadvantageous, and concentrate a great variety of capital. The state and each of the provinces will divide up the burden of the investment, with each benefitting and each supplementing and benefitting the others. This has played an enormous role in accelerating development. It can be expected that as this agreement is actually implemented and as it reinforces the economic strengths from developing the Lancang Jiang and other cascade hydropower stations, the speed of development and construction of the cascade power stations on the middle and lower reaches of the Lancang Jiang will be greatly accelerated. Moreover, this model will also play a role in promoting development of hydropower throughout China.

Developing Hydropower for the Goal of Rural Electrification

916B0091A Beijing SHUILI FADIAN [WATER POWER] in Chinese No 7, 12 Jul 91 pp 1-7

[Article by Ministry of Water Resources vice minister Zhang Chunyuan [1728 2505 0954]: "Actively Develop Rural Hydropower, Strive To Achieve Rural Electrification"]

[Text] Editor's note: From 15 to 20 Apr 91, the State Planning Commission and Ministry of Water Resources jointly convened the National Rural Hydropower and Second Group Rural Hydropower and Initial Electrification County Work Conference in Beijing. We are now publishing an abstract of Ministry of Water Resources vice minister Zhang Chunyuan's speech.

I. A Review of Rural Electrification Trial County Construction Over the Past 5 Years

With approval by the State Council, work began throughout China in 1985 to establish 100 rural electrification trial counties. For the past 5 years, under the personal concern of premier Li Peng and through the arduous efforts of large numbers of employees in the Ministry of Water Resources and millions of the masses in mountainous regions, China now has 109 counties that have attained initial electrification standards, satisfactorily completing the task given us by the State Council. The first group of 109 counties to attain initial electrification standards have a total population of 7.10 million peasant households and 30.40 million people. These counties are distributed throughout old revolutionary base area, minority, mountainous, frontier, and poor regions in 20 provinces (autonomous regions). They include 36 key state and provincial poverty assistance counties and 36 minority nationality counties for a total of 72 counties. Before the trials, most of these counties were poor mountainous counties with relatively backward economies that have lacked electric power for a long time. Many of the peasant households do not have electricity and economic development has been extremely slow. After 5 years of arduous efforts, their abundant local hydropower resources have been developed. Average yearly per capita power use and per household power use both now exceed 200 kWh and 96 percent of the peasant households have electricity. The development of water conservancy and hydropower has promoted comprehensive development of the economy of these mountainous regions and strengthened local finances. Popularization of electric power has

promoted construction of material civilization and spiritual civilization in rural areas and brought preliminary changes to impoverished and backward mountainous areas.

A. It has spurred comprehensive development of mountain area economies, four doublings have been achieved in economic development in 5 years

1. With popularization of electric power, power output has doubled

The installed generating capacity in the 109 counties increased from 1,406MW prior to the trials to 2,446MW, an increase of 1,040MW. Yearly power output increased from 3.75 billion kWh to 7.94 billion kWh, a 1.25-fold increase or more than double. Average annual per capita power use reached 243 kWh and the electricity availability rate for peasant households reached 96 percent.

2. The gross value of industrial and agricultural output has doubled, the value of industrial output has quadrupled, and the value of output in township and town enterprises has increased 6-fold

Electrification has provided a motive force for economic development in mountainous regions and there has been rapid development of county-run industry, township and town enterprises, and agricultural and sideline processing industry. Commerce has been opened up and service industries are flourishing. The gross value of industrial and agricultural output in the 109 counties increased from 11.79 billion yuan prior to the trials to 26.88 billion yuan, a 168 percent increase or double the amount. The value of industrial output increased from 4.24 billion yuan to 16.63 billion yuan, a quadrupling. The value of out from township and town enterprises increased from 1.23 billion yuan to 8.83 billion yuan, an almost 6-fold increase. River control and development and construction of rural water conservancy and hydropower have effectively promoted changes in agricultural production conditions and provided comprehensive benefits including power generation, flood prevention, irrigation, water supplies, and so on. It also can be used to develop electric-powered irrigation and drainage and provide supplies of electric power for small chemical fertilizer, small farm chemical, small agricultural machinery, and other industry to support agriculture.

A common experience in the ability of the economies in these trial counties to develop quickly has been that rural hydropower has led the way in promoting a flourishing situation in hundreds of activities that have brought a rapid startup to the slowly-developing mountain economies and enabled them to develop more quickly. Because of the adoption of the policy of "using power to develop power", the trial counties now have an average of more than 1 million yuan each year in "using power to develop power" capital that can then be used for rolling development of small-scale hydropower and providing definite reserve strengths for economic development. This has moved the economies of these mountainous regions onto the benevolent development path of "using hydropower to promote power, using power to promote industry and invigorate agriculture, and using industry to invigorate power". Leaders in many provinces and counties said that "for mountainous regions to develop, they must first develop small-scale hydropower" and "developing small-scale hydropower to support poor areas truly provides points of support". Electrification via rural hydropower has found a new way to change the backward face of poor and mountainous regions and gradually eliminate poverty and bring prosperity.

3. Peasant per capita incomes have quadrupled

With the availability of electric power and the surplus labor in rural areas, township and town enterprises, which mainly develop local resources and agricultural and sideline products, have developed in a surging fashion. One-fifth of the rural labor force of the 109 counties, equal to about 2 million people, has shifted from agriculture to township and town enterprises and county-run industry. The popularization of electric power has changed the traditional life of "going out to work at sunrise and not resting until sunset" that the peasants of mountainous regions have lived for several thousand years. Large numbers of peasants can use their evenings and slack farming periods to develop household sideline industry and increase their incomes. The average annual incomes of peasants increased from 203.8 yuan per capita prior to the trials to 620.4 yuan, a 2-fold increase and slightly higher than the average peasant per capita income level in all of China during that year.

4. County financial incomes have quadrupled

Before the trials, the lack of electric power meant that most counties had not developed county-run industry and township and town enterprises and that county finances in most cases relied on state subsidies to get by. The difficult situation of "going into debt from running mines and suffering losses from running plants" appeared in many counties because of inadequate electric power supplies. After the achievement of initial electrification, however, county and township industry developed quickly and financial incomes have grown in a stable manner. The total financial income of the 109 counties increased from 570 million yuan to 2.12 billion yuan and county financial income nearly quadrupled.

B. It has promoted construction of spiritual civilization in mountainous regions

With the popularization of electricity use, the television coverage rate of the trial counties reached more than 80 percent. Radio, television, and household appliances have quickly been popularized. The peasants learn about major affairs of the state and party policies from their televisions and radios. They receive scientific, technical, and commercial information that opens their vistas, increases their knowledge, and enriches their cultural lives. The popularization of electric power has promoted development of cultural and sports activities in rural areas It has promoted the popularization of education on electrification in township and town schools and improved teaching conditions. The "three more and three less" phenomena, referring to more concern for major national matters, more study of science and culture, more new people and new activities,

less feudal superstition, less appealing to the gods and praying to Buddha, and less gambling and fighting have appeared in rural areas. The common people in mountainous regions say "electrification is an important and good thing that the CPC has done for us".

C. It has protected forests and promoted improvement of the ecology and environment in mountainous regions

The electrification counties have used their abundant local hydraulic resources to develop electric heating. Formerly, they used firewood and charcoal to roast tea, dry tobacco, fire porcelain, and process agricultural and sideline products. Now they have universally shifted to electric heating. There are also about 20 percent, meaning 1.4 million peasant households, that use electricity for cooking during the wet season, which conserves about 2.20 million m^3 of timber each year. "Substituting electricity for firewood" makes full use of local hydraulic resources and makes production and life more convenient, and it effectively protects the forests. It prevents water loss and soil erosion, improves the ecology and environment, promotes development of agriculture, forestry, animal husbandry, and sideline production in mountainous areas, and forms a benevolent ecological cycle of "using electricity to protect forests, using forests to protect water and soil, lush forests and abundant grain".

D. It has promoted hydropower construction throughout China's rural areas

The state has formulated a set of policies for local development of small- scale hydropower for the trial counties that have greatly motivated initiative in local policy and water conservancy departments at all levels and of the masses for small-scale hydropower construction. By the end of 1990, the small-scale hydropower installed generating capacity managed by water conservancy departments was 13,180MW and they generated 39.28 billion kWh of power annually. Compared to 1980, this was an increase of 6,250MW or 90.2 percent in the installed generating capacity and an increase of 26.5 billion kWh or 208 percent in yearly power output. Rural hydropower generated a total of 41.8 billion kWh during 1990, up 12 percent from 1989. They completed 1,024MW in medium and small-scale hydropower installed generating capacity (including associated small-scale thermal power), up 7.5 percent from 1989. The average number of utilization hours of small-scale hydropower generating equipment was 3,113 hours, up 196 hours from 1989. Over the past several years, as all areas have been striving to develop small-scale hydropower, they have also been active in building medium-sized power stations and developing regional power grids. There is now 1,250MW in medium-scale hydropower installed generating capacity under construction and 39 multi-county regional grids have taken initial shape. There were nine counties not originally included among the trial counties that attained the standards through their own efforts and "self-study in skills".

For the past 5 years, the trial electrification counties have made major achievements in their work and accumulated rich experience, the main parts being:

1. Attention of leaders

A high degree of concern has been given to rural electrification from the central authorities down to province, prefecture, and county-level leaders. Planning, electric power, finance, banking, taxation, price, materials, and other departments have provided considerable support. Many provinces and autonomous regions have established leadership groups and offices commanded by primary leaders that have organized and coordinated forces in all areas and supported electrification construction. Governments in the counties and townships have established construction leadership groups commanded by primary leaders themselves and powerful working groups that are focusing on electrification as a major affair for invigoration of their regional economies, breakthroughs in eliminating poverty and achieving prosperity, providing facts to the people, and so on. The concern of leaders and their true focus on the matter is the key to completing trial electrification work.

2. Relying on their own efforts

Completion of electrification within a short time period is due mainly to relying on the forces of local areas and the masses and fostering the spirit of relying on one's own efforts and arduous struggle. The 109 electrification counties invested a total of 4.1 billion yuan in construction over 5 years. This included 100 million yuan a year from the state in the shift from allocations to goods, for a total of 500 million yuan, which was just 12.2 percent of the total invested. Local areas (including local credit, provincial and prefectural subsidies, "using power to develop power" capital, funds to support poor areas, water conservancy capital construction, agricultural water use fees, and so on) raised 2.5 billion yuan themselves, equal to 58.5 percent of the total investment. The masses themselves raised 1.2 billion yuan by providing labor and raising capital, equal to 29.3 percent of the total investment.

3. Implementing policies

Premier Li Peng personally led the formulation of policies calling for implementation of the "three selfs" principle for "self-construction, self- management, and self-use" in rural hydropower and electrification and for "using power to develop power" and local areas setting their own electricity prices; "small-scale hydropower should have its own power supply region" and implement a rural hydropower management system that unifies generation, supply, and utilization; large grids should adopt a series of principles and policies for support, concessions, and so on for small grids, provide small-scale hydropower development with stronger vitality, and substantially motivate initiative of local areas and the masses for developing power. They not only guided and guaranteed smooth completion of rural electrification work but also enormously promoted flourishing development of China's hydropower industry.

4. Scientific planning

Planning must lead the way for good electrification work. All of the trial counties used economic and social development in their region as a foundation for using demand

for electric power to forecast equilibrium in electricity use; to integrate with their regional comprehensive river basin control and development plans to carry out cascade development; to integrate medium and small scales in power station construction and proceed first with construction of key hydropower stations with good comprehensive utilization benefits and regulation capabilities; to do good planning for power grid frameworks and construction of economically rational, stable, and reliable grids; and to include technical upgrading and technical progress in existing hydropower stations and power grids in electrification plans and make preferential arrangements for them.

5. Concern for results

Rural hydropower and electrification work adhered to the principle of combining generation and supply, combining construction and administration, being concerned with results, and serving rural areas. They reinforced grid construction and management, undertook "three types of power" work, reduced consumption, oriented toward rural areas and served rural areas, and continually improved the quality of power supplies. Statistics indicate that not only did they supply electricity to 96 percent of peasant households, but they also reduced their grids' overall grid loss rate from 18.01 percent to 11.3 percent, increased the yearly utilization time of power generation equipment from 2,529 hours to 3,246 hours, and increased profits and taxes in electric power enterprises from 60 million yuan to 240 million yuan, a 4-fold increase.

Practice has shown that the State Council's decision to rely on the strengths of local areas and the masses in regions with abundant hydropower resources for active development of local hydraulic resources and construction of Chinese-style rural electrification counties is correct and that the trials were successful. This is an effective way for regions, especially nationality regions and poor regions, to foster the spirit of relying on their own efforts and arduous struggle, rapidly throw off their poverty, and move their economies toward stable and coordinated development. It can also provide significant benefits in a bountiful harvest in building material civilization and spiritual civilization. It is a good method that conserves investments and produces results quickly, it easily motivates the initiative of local areas and the masses to rely on their own efforts to make rapid changes in the backward situation of mountainous areas and received deep support from the masses and local governments at all levels. It is playing a major role in reinforcing unity of our nationalities and in consolidating and stabilizing our frontiers.

II. Rural Hydropower and Initial Electrification County Construction Tasks for the Next 10 Years

The preliminary program for China's water conservancy system in developing rural hydropower and electrification counties calls for building medium-sized water conservancy and hydropower projects and placing 5,000MW of installed generating capacity into operation and 7,000MW of small-scale hydropower installed generating capacity into operation, and building 500 rural hydropower and initial electrification counties. By the year 2000, the medium and small-scale hydropower installed generating capacity should increase from 14,000MW to 26,000MW and the number of rural initial electrification counties should surpass 600. Moreover, several large comprehensive utilization water conservancy projects will be built and an installed generating capacity of 3,000MW placed into operation. The total hydropower installed generating capacity in the water conservancy system should increase from the present figure of 15,000MW to 30,000MW. As rural hydropower develops, rural power grids will be continually perfected and developed, there will be substantial improvements in the quality, reliability, and extent of automation in grid power supplies, and the economic benefits of grids will be further improved.

Construction will begin on 95 medium-scale water conservancy and hydropower projects during the Eighth 5-Year Plan. The construction scale will be 4,750MW and 2,000MW will be placed into operation. The small-scale hydropower installed generating capacity placed into operation will be 3,000MW. Beginning in 1991, the average rural hydropower installed generating capacity placed into operation each year during the Eighth 5-Year Plan will exceed 1,000MW.

State Council Document No 17 (1991) made the decision in its notice approving and passing on the Ministry of Water Resources' "Request for Instructions Regarding Construction of the Second Group of Rural Hydropower and Initial Electrification Counties" that 200 rural hydropower and initial electrification counties will be built during the Eighth 5-Year Plan. These 200 counties have a population of 70 million people and are located in 24 provinces (autonomous regions) throughout China. They include 25 counties in Sichuan Province, 22 counties in Fujian Province, 20 counties in Hunan Province, 20 counties in the Guangxi Zhuang Autonomous Region, 16 counties in Jiangxi Province, 15 counties in Yunnan Province, 15 counties in Zhejiang Province, 14 counties in Hubei Province, 10 counties in Guangdong Province, six counties in Guizhou Province, six counties in Jilin Province, and six counties in the Xinjiang Uygur Autonomous Region. There are one to four counties in each of the remaining provinces (autonomous regions). Of the 200 rural hydropower and initial electrification counties in the second group, 153 or 76.5 percent are in minority nationality areas, national and provincial key poverty support counties, and old revolutionary base areas. Calculations indicate that 2,200MW in additional installed generating capacity will be required to bring the second group of 200 rural hydropower and initial electrification counties up to standard at a total investment of more than 9 billion yuan and plans call for completion in 5 years. There are quite a few other counties that have requested to be included in the second group of rural hydropower and initial electrification counties. These counties can take action to create the conditions for rural hydropower construction and work on "self-study in skills".

The trial counties that have achieved initial electrification must soberly understand that our initial electrification level is still very low. It will take considerable electric

power to completely transform backward mountainous areas. They must overcome the ideology of "waiting for the ship to arrive at the dock and waiting for the train to arrive at the station", continue fostering the spirit of relying on their own efforts and arduous struggle, utilize good conditions created by the trials, advance without stopping, and use active development of hydropower to raise electrification levels even higher.

III. Some Items of Work That We Should Focus On in the Short Term

A. Improve understanding, reinforce leadership

The "People's Republic of China National Economic and Social Development 10- Year Program and Eighth 5-Year Plan Outline" approved by the 4th Session of the 7th National People's Congress is the outline for socialist modernization for the people of all of China's nationalities during the 1990's. The "Outline" makes it clear that agriculture, water conservancy, energy resources, and active support for economic development of nationality areas are the focus of economic development over the next 10 years. Actively developing rural hydropower and achieving rural electrification concern the invigoration of agricultural, water conservancy, and energy resource construction and the economy of our vast mountainous regions and concern the achievement of relative prosperity for the several 100 million people of mountain regions. Actively developing rural hydropower and building electrification counties are important aspects of implementing the "Outline". Comrades in our water conservancy and hydropower departments should work under the leadership of the government at all levels and have a spirit of extreme responsibility, treat the task of building the second group of rural hydropower and initial electrification counties as a major affair by the CPC Central Committee and State Council for the masses of mountainous regions that must be done well and realistically, and truly be grasped well. Experience in the trial counties tells us that leadership is the key to good electrification. The task of building the second group of electrification counties involves double the tasks of building the first group of electrification trial counties. The scale of the project is very large and the tasks are arduous, so there is an even greater need to strengthen leadership. We hope that provinces, prefectures, and counties with heavy tasks will organize rural hydropower and electrification construction leadership groups under the command of cadres with primary administrative responsibility and that they will establish crack management organs, organize and coordinate forces in all departments, and promote construction of rural electrification.

The 7th Plenum of the 13th CPC Central Committee and the 4th Session of the 7th National People's Congress fully affirmed the role of water conservancy in national economic and social construction, that it serves as an important basic facility and basic industry, and that hydropower and water supplies are the most vigorous part of the water conservancy industry. While focusing on flood and drought prevention, farmland irrigation, water and soil conservation, river control and development, and other items of work, water conservancy and hydropower departments at all levels should certainly concentrate on doing good work on hydropower and water supplies to promote development of the entire water conservancy industry. Experience in the trial counties shows that when rural hydropower develops, farmland water conservancy in mountainous regions also develops along with it and water conservancy departments become more active. We hope that provinces and autonomous regions with rural hydropower construction tasks, especially in south China, will reinforce rural hydropower work and they should have a department leader responsible for rural hydropower and electrification work. Six provincial departments in China have now established independent management organs but their forces are weak, so we hope they will be further firmed up and strengthened to meet the requirements of rural hydropower and electrification construction tasks during the 1990's.

B. Focus on doing good preparatory work for plans and projects

Counties included in the second group for rural hydropower and initial electrification should first of all organize their forces, conduct survey research, and prepare good initial electrification plans based on requirements in the Eighth 5-Year Plan for economic development in their counties and initial electrification standards and on the basis of their county's water conservancy and hydropower plans for the Eighth 5-Year Plan. During the planning process, they should certainly adhere to the principles of adapting to local conditions, seeking truth from facts, and being concerned with results. In regions where the masses are relatively dispersed, they can develop some micro-scale hydropower run by households or groups of households and the construction of power sources should mainly involve small-scale hydropower. Rural hydropower construction should be integrated with water control and there should be comprehensive utilization plans for river basins for carrying out cascade development and building first those key reservoirs with regulation properties and appropriate scales to gain the maximum returns to investments. It would be very uneconomical to build power source sites in some counties, so consideration can be given to joint construction of power stations in nearby counties or regions based on the principle of equality and mutual benefit and dealing properly with the rights and relationships of each party. Consideration can also be given to implementing five divisions: joint division of property rights, division of power, division of profits, division of taxes, and division of output value. In regional power grids, there can be unified construction of power source sites by the grids. Plans should pay special attention to rational deployment of frameworks and they should include exploiting potential and upgrading of existing grids and power source sites in plans. To promote planning work in rural hydropower and initial electrification, we are preparing to convene a planning meeting for the 200 electrification counties in May 1991 and we hope that all areas will focus on making good preparations after the meeting.

Areas with abundant rural hydraulic resources should integrate with development of water conservancy and focus on preparing good rural hydropower programs and the Eighth 5-Year Plan for their regions and counties over the next 10 years. In the plans, special mention should be given to the issue of small-scale thermal power. In grids dominated by rural hydropower, insufficient output during the dry season could allow appropriate construction of a few small-scale thermal power plants in regions having coal resources, but they should be strictly controlled because they consume large amounts of coal and are expensive. Recently, following development of water conservancy and hydropower construction, a situation has appeared in which preparatory work for projects has failed to keep pace. I hope that water conservancy (hydropower) departments at all levels will focus on preparatory work for projects, clearly understand the nation's water conservancy and hydropower construction situation for the 1990's and be willing to provide forces and money.

C. Further implement all policies for rural hydropower

State Council Document No 17 (1991) clearly points out that besides continuing to implement all state policies regarding support for small-scale hydropower, we should also provide additional support in construction capital sources, electricity prices for small-scale hydropower, establishing small-scale hydropower construction funds and construction capacity, and other areas according to the instruction and spirit of premier Li Peng to "provide further support for small-scale hydropower" and of vice premier Zou Jiahua to "actively support the development of rural hydropower". We should conscientiously implement and comprehensively adhere to the relevant provisions of the State Council's Document No 17 (1991).

Regarding construction capital, State Council Document No 17 (1991) clearly points out that capital raising by local areas themselves should be the main source, with the state providing the needed support. Based on experiences in all areas, capital raising by local areas includes construction funds at all levels, bank loans, financial support, retained energy resource and communication funds, capital for supporting the poor, work provided as a form of relief, frontier support capital, water conservancy capital construction and small-scale rural hydropower subsidy funds, "using power to develop power" capital, the electric power construction fund of 0.02 yuan that is requisitioned, contributions of labor by the masses, capital raised by enterprises and the masses, using foreign investments, and so on. In this regard, we must give special thanks to planning departments, financial departments, the State Energy Resource Investment Company, People's Bank, Agricultural Bank, Construction Bank, Industry and Commerce Bank along with taxation, price, electric power, materials, and other departments for the support they have provided.

Electricity prices are the key to rural hydropower loan repayment, normal operation, and development. After the National Rural Hydropower Conference in 1989, many provinces have readjusted electricity prices for rural hydropower. Liaoning, Zhejiang, Anhui, Guangdong, Hunan, Hebei, and other provinces have increased the price paid for electricity supplied to large grids from 0.10 yuan to 0.30 yuan. Most provinces have also readjusted electricity prices in small local grids, raising them from the former approximately 0.05 yuan to 0.10 to 0.20 yuan. Although there were definite increases in electricity prices for rural hydropower in 1989, they are still low overall. This is especially true of the price of electricity supplied to large grids in many regions that is still at the original level of 0.035 to 0.05 yuan per kWh. The price of electricity within small local grids is also too low. To increase the loan repayment capabilities and self-development capabilities of small-scale hydropower, there should also be appropriate increases in the electricity price for rural hydropower. They should be raised to approximately the average electricity price in local large grids.

The state has provided small-scale hydropower with "using power to develop power" and other preferential policies and the goal is to establish rural hydropower's own self-development mechanisms. Based on the spirit of State Council Document No 17 (1991), all areas should use "using power to develop power" capital and the electric power construction fund of 0.02 yuan that is requisitioned, income from higher electricity prices, the principal and interest recovered from compensated utilization of capital, and so on and centralize it to establish rural hydropower development funds at various levels and implement compensated utilization and rolling development. The rural hydropower development funds should be treated as special accounts for special purposes.

D. Reinforce rural hydropower grid construction

Given China's existing electricity management system and electricity price policies, to implement the state's various policies regarding support for small-scale hydropower and promote the development of rural hydropower, we should conscientiously adhere to premier Li Peng's instructions that have repeatedly emphasized that small-scale hydropower should have its own power supply regions and that rural hydropower grid construction should be reinforced.

Grid integration is an inevitable trend in the developing electric power. As rural hydropower has developed, counties joining together to form integrated regional grids has grown very quickly in the past several years. As rural hydropower develops, all areas with the proper conditions should actively advocate that counties join together to integrate their grids and establish regional grids.

We should work to achieve better relationships with large grids. At present, the scale of rural hydropower regional grids is relatively small and they have poor regulation capacities, insufficient power supplies during dry seasons and excess electric power during wet seasons, which poses considerable difficulty for grid operation. Besides actively building power stations with regulation capabilities and developing several energy consuming industries that use seasonal electricity during the wet season, we should also advocate integration of their grids with national grids, obtain support from large grids, and increase the power

supply capacity and power supply quality during the dry and wet seasons. In the past, electric power departments at all levels provided much assistance and support in building and managing rural hydropower and their grids, especially regarding the question of grid integration. Electric power departments have rich experience in electric power construction and management, their management levels and technical levels are both relatively high, and their systems of regulations are also rather complete. All of these things deserve our study. At present, relationships between large and small grids are good overall, but both parties are economic entities and there are naturally phenomena of some uncoordination in certain places. We should adhere to the principles of "unity in controlling grids, mutual understanding and mutual concessions, equality in consultations, contractual dispatching, and joint development" in actively discussing and solving the problems and in taking action to have good relations with large grids. When consultations on certain problems are not successful, coordination can be requested from the local government. When they cannot do the coordination, adhere to achieving overall agreement with minor differences and strive to create the conditions for resolution.

E. Actively develop medium-scale hydropower

For the past several years, as the economies of mountainous regions and rural hydropower have developed and their capacity for developing power has been strengthened, all areas have been very enthusiastic about developing medium- scale hydropower and it has grown very quickly. A gratifying situation of "small-scale hydropower as the foundation, medium-scale hydropower as the backbone, and regional grid integration" has appeared. While actively developing small-scale hydropower, rural hydropower should also advocate that prefectures serve as the units for organizing the construction of medium-scale hydropower in locations with the proper conditions. At present, the biggest defects in the structure of rural hydropower power sources are a large proportion of runoff power stations, excess electric power during the wet season, and inadequate electric power during the dry season. Thus, we should give preference to building key power stations with comprehensive utilization and regulation properties when building medium-scale hydropower to readjust the structure of power sources. The necessary support should be given to all areas in building medium and small-scale key hydropower and regional grids.

F. Reinforce management, improve economic results

1991 is "quality, product variety, and results" year. We ask that comrades in water conservancy departments actively participate in these activities, reinforce administration and management, continually increase the economic benefits of water conservancy, and promote development of the basic water conservancy industry.

Management is a force of production. The problem of strengthening management exists in all areas in rural hydropower including construction, operation, production, and so on, and we must focus on extension as well as intension. We must overcome the tendency toward stressing construction while neglecting management and stressing generation while neglecting supplies. In the past few years, reinforced management has made definite achievements in increasing the utilization time of rural hydropower and reducing grid losses, but the equipment health levels of rural hydropower are still rather poor. According to incomplete statistics, about one-third of our 15,000MW of hydroelectric power generation equipment is of poor quality and has low efficiency. The overall efficiency of generators is less than 70 percent and grid line losses average about 15 percent, so there should be rectification and upgrading. We should prepare good rectification and upgrading plans for power stations and grids and we should manage and use depreciation and major overhaul funds well. We must put rectification and upgrading work for existing power stations and grids in an important status and make a firm decision to improve them. The requirement for 1991 is for the power generation equipment completion rates in large and medium-sized hydropower stations and key small power stations managed by water conservancy departments and in initial rural electrification counties to exceed 95 percent. The overall efficiency of generators should reach 80 to 85 percent. Grid losses in rural hydropower grids should be reduced 1 percent from 1990. We must do good work on demarcation of property rights and management of fixed assets. Equipment management is the foundation of enterprise management. To do equipment management work in water conservancy departments truly well, the Ministry of Water Resources will issue its "Provisions for Ministry of Water Resources Equipment Management". We should use assessment of equipment grades to gradually develop equipment management work in rural hydropower enterprises. We should develop standardized management activities, integrate with technical upgrading and technical progress, and spend 5 years or slightly longer in making significant improvements in the technical equipment levels of rural hydropower stations and their grids. At the same time, we should establish and perfect various systems of regulations, reinforce comprehensive training of employees and job training, improve the overall quality of enterprises, and achieve safety, economy, superior quality, and high efficiency in power generation, supply, and production.

At present, there are phenomena of seriously excessive numbers of personnel and lax financial management in the management of some rural hydropower enterprises that seriously affect improvement of economic results and management levels in enterprises. Rural power management units at all levels should strive to gain the support of their local CPC committee and government, do survey research, formulate methods, adopt effective measures to strictly control personnel increases, reinforce financial management, and improve economic results.

Raising the grades of enterprises is an effective and important reform in China's enterprise management methods, and it is an effective way to increase the quality of management and economic results in enterprises. After the founding of the new Ministry of Water Resources, we began work on raising the grades of upper level enterprises.

During the Eighth 5-Year Plan, we should make raising enterprise grades an important aspect of work to raise enterprise management levels in the water conservancy system. Rural hydropower enterprises occupy an important status in raising the grades of enterprises under the Ministry of Water Resources. While building the second group of rural hydropower and initial electrification counties, we should also do good work on plans for raising the grades of rural hydropower enterprises, try to move 20 to 30 of our rural hydropower enterprises into the ranks of national advanced enterprises and 150 to 200 enterprises into the ranks of ministry-level advanced enterprises during the Eighth 5-Year Plan. This would greatly change the situation of rural hydropower enterprises and raise management levels and economic benefits.

Safe production is a first-rate matter in enterprises, especially in rural hydropower and their power supply departments. Safety work must be placed in an important status and we must conscientiously adhere to the principle of "safety first". Plant directors (managers) are the primary responsible persons for safe production in enterprises. We should establish and perfect a safety management system with graded responsibility with plant directors (managers) at the head. We should form a system of fixed schedule inspection and examination, and we should reinforce safety technology training and education in discipline for employees. We should reinforce propaganda and education work on safe power use and power conservation in our vast rural areas.

G. Reinforce personnel training and staff construction

We should adopt a method that integrates educational training by sending people out and bringing people in with job training in the second group of rural electrification counties. The Ministry of Water Resources is preparing to entrust the relevant institutions of higher education to train specialized personnel in phases and groups for the second group of rural electrification counties. All provinces (autonomous regions) should formulate personnel training plans for the electrification counties within their province (autonomous region) and they should take full advantage of the relevant colleges and universities within their province to train personnel for their rural hydropower and electrification counties. Local electric power enterprises should formulate short and long-term employee training plans based on the cultural structure and specialization levels of the employees of their units and undertake post training.

To complete our rural hydropower construction tasks for the 1990's, we must construct a good staff. We must reinforce construction of leadership groups at all levels in the rural hydropower system. We must reinforce political and ideological work for our staffs, resolutely focus on both material and spiritual civilization, and actively develop activities to learn from Lei Feng and establish a new working style in the industry for posts. We must gradually establish a powerful staff that wholeheartedly serves the people of mountainous regions in rural hydropower staff construction.

H. Ensure the completion of the 1991 task for an installed generating capacity of 1,000MW

1991 is the first year of the Eighth 5-Year Plan. The State Planning Commission has arranged for the task of completing an installed generating capacity of 1,000MW for rural hydropower. We must establish a concept of operationalization and a concept of time, and try in every way possible to complete this task. For the projects included among those to go into operation during 1991, all provincial (autonomous region) departments (bureaus) should reinforce leadership over these projects, strengthen construction planning and management, immediately solve problems during construction, and provide key guarantees for the materials, equipment, capital, information and so on that they require. Construction units should begin immediately in focusing on preparatory work prior to the operationalization of each project.

The construction tasks for the first group of initial rural electrification counties have been victoriously completed and construction of the second group of rural hydropower and initial electrification counties has begun. Reviewing the past and looking toward the future, we are full of confidence and hope. We must conscientiously implement the "People's Republic of China National Economy and Social Development 10-Year Program and Eighth 5-Year Plan Outline" approved by the 4th Session of the 7th National People's Congress, have a spirit of struggle, unite in cooperation, rely on our own efforts, engage in arduous struggle, actively develop rural hydropower, strive to complete the construction tasks for the second group of rural hydropower and initial electrification counties, and make a contribution to achievement of our second strategic objective!

Three-Billion-Yuan Power Project Set

40100003B Beijing CHINA DAILY (Economics and Business) in English 12 Oct 91 p 2

[Text] China has appointed a major industrial company to undertake hydropower projects on the Wujiang River in Southwest China.

The Wujiang Hydro Development Company will be responsible for the construction of eight hydropower projects on the river, believed to be the Yangtze River's richest tributary in terms of hydropower potential.

Seven of the eight projects are still under planning while one is under construction.

The company was recently established by local investors from Guizhou Province and the State Energy Investment Corporation (SEIC), the government's principal financier in coal and electricity projects.

The move is known to be part of the government's programme to help Guizhou's economic take-off, shackled in part by persistent electricity shortages.

The government said these projects are indispensable for the general development of Guizhou, an economically backward region which is rich in mineral resources but short of the electric power to develop them.

One project, the Wujiangdu has been in operation since 1983 and has a capacity of 6.3 million kilowatts while the one under construction will have a capacity of 5.1 million kilowatts. These nine projects will be capable of producing 40 billion kilowatt hours of electricity a year, according to sources involved in the planning work. They said the whole undertaking will take another 25 years to complete.

Investment will be shared between the State and local investors. The latter may include the eventual users of the electricity produced.

Upon completion of the projects, Guizhou will have enough electric power for large-scale development of mineral resources in the Wujiang River basin. The basin covers 88,000 square kilometres and boasts South China's largest coal deposits with an estimated reserve of 30 billion tons.

Other mineral ores include 2.58 billion tons of phosphate and 270 million tons of bauxite, both of which are key raw materials in chemical and metallurgical industries.

China has long been a major importer of phosphate fertilizer and aluminum, draining its precious hard currency reserves.

But development of the highly power-consuming industry has been restricted by lack of investment into the power industry, especially in such inland regions as Guizhou.

The State Energy Investment Corporation has promised increased funding for the Wujiang projects, but has meanwhile urged for local investors to play a bigger part in financing the project.

Big Power Generators To Minimize Imports

40100002B Beijing CHINA DAILY (Economics and Business) in English 26 Sep 91 p 2

[Text] Production of China's largest coal-fired electricity generators will soon rely almost completely on locally supplied components, rather than imports.

In order to encourage the production of machinery and equipment domestically, the Ministry of Machinery and Electronics Industry recently demanded that by 1995, Chinese manufacturers supply at least 90 percent of components for the production of 600,000-kilowatt generators, designed to be the mainstay of China's electricity industry up to the next century.

Chinese factories are now working on the production of a third such generator, following the smooth installation of the other two in East China's Anhui Province.

The ministry said the new machine will depend on local sources for 85 per cent of components, compared with 50 and 76 percent for the other two.

In the past decade, millions of kilowatts of generating equipment have been purchased from abroad, draining the industry's precious hard currency reserves and leaving much of the domestic production capacity idle.

Chinese manufacturers were not able to produce such large-capacity generators until the introduction of American technology in 1981. But they still have to import certain parts.

According to the ministry, key components of the machine will be manufactured by three firms in Harbin in Northeast China's Heilongjiang Province while about 100 others will be responsible for minor supplies.

A 600,000-kilowatt thermal power unit consumes 200,000 tons of coal less annually than three 200,000-kilowatt units working together.

So far, 200,000-kilowatt units form the backbone of the industry's generating equipment, the world's fourth largest. Total installed capacity was 140 million kilowatts by the end of this June.

The government plans to put into operation another 10 million kilowatts a year up to the year 2000, most of which should be equipment of 600,000 or 300,000 kilowatts in capacity.

Electricity Potential Tapped in Southwest

40100003A Beijing CHINA DAILY (Economics and Business) in English 5 Oct 91 p 2

[First four paragraphs were in boxed in area in the article]

[Text] The central government has allowed the electricity industry to use 2.2 billion yuan ($410 million) to be raised in the form of bonds this year, according to the State Energy Investment Corporation (Seic).

The money is part of the 10 billion yuan ($1.9 billion) worth of construction bonds the government has planned to float in 1991.

Electricity from the stations built with these funds will be sold at higher prices since the three-year bond carries an interest rate of about 11.2 per cent within the period.

Seic is working out measures to ensure the repayment of the bonds. It is also carrying out feasibility studies of projects jointly using the funds with the Construction Bank of China.

China's leading State energy investor recently signed an agreement with local financiers to jointly build and manage a large hydropower station on the Yellow River.

Under the arrangement, the State Energy Investment Corporation (Seic) will invest 80 percent of the 3-billion-yuan ($559 million) Lijiaxia hydropower station project in Northwest China's Qinghai Province.

The remaining 20 percent will be polled from Shaanxi, Gansu and Qinghai provinces and Ningxia Hui Autonomous Region. Of the 20 percent investment, Shaanxi and Gansu will contribute 36 percent each, Qinghai 18 percent and Ningxia 10 percent.

Experiment

Joint investment for energy development from central and local authorities is a recent experiment in China, carried out as the government has not the means to finance all construction projects.

The Lijiaxia power station will be constructed 55 kilometres south of Xining, capital of Qinghai Province.

A 165-metre high and 430-metre long dam will be built. With a designed output exceeding 5.9 billion kilowatt hours of electricity a year, it will ease energy shortages and assist economic development in the Northwest, one of the poorest regions in China. On completion the power station will be connected to the Northwest Power Network.

Of the total investment, 2.2 billion yuan ($410 million) will be used to build the power station. The remaining 800 million yuan ($149 million) will be spent on electricity transmission.

The first phase of the project includes four generators with a total capacity of 1.6 million kilowatts. The first of the four will start operation in 1996, and the others will begin running three years later.

The agreement states that the property right, electricity and profit distribution between the five parties will be decided according to the investment shares. The investors will not receive dividends until the power station pays back its bank loans.

A board of directors formed and empowered by the investors, will become the decision-making body of the construction and, later, form the management board of the station.

Water and coal have been the chief resources to generate electricity in China. However, less than 10 percent of the exploitable hydropower potential in China has so far been developed.

There are already several major power stations in operation on the Yellow River, including Longyangxia, Liujiaxia and Qingtongxia. The Lijiaxia power station is expected to contribute to further development of the Yellow River, one of the major regions for future power development.

Anhui Ambitious in Power Output

40100002C Beijing CHINA DAILY (Economics and Business) in English 2 Oct 91 p 2

[Article by staff reporter Huang Xiang]

[Text] Huainan in Anhui Province, the leading energy powerhouse in electricity-starved East China, is planning a major boost in coal and electricity production to back up the province's economic growth in the next 10 years.

Coal mines under the State-run Huainan Mining Bureau are expected to turn out 20 million tons of coal a year by the year 2000, 10 million tons more than in 1990.

Electricity generation from coal-fired plants will amount to 26 billion kilowatt hours a year by the end of the century, up from the projected output of 16 billion in 1991, according to the Ministry of Energy Resources.

The target is critical for further economic growth in East China, which saw the fastest development in the last decade but has yet to undergo fully-fledged development due to electricity shortages, a ministry official explained.

The new development plan for Huainan, one of the region's few major energy suppliers, will enable the whole region to be less dependent on power supplies from faraway Central and North China, a factor responsible for a significant rise in production costs.

The core of the development strategy, said the ministry, involves the construction of three major coal mines and two coal-fired power plants.

The Xieqiao coal mine, the largest of the three under construction, will be capable of producing four million tons a year while each of the other two will have an annual capacity of three million tons.

Their total capacity by the end of the century will keep the Huainan Mining Bureau high on the industry's top-10 list in terms of production capacity.

Huainan became one of the largest coal producers last year, turning out a record 10 million tons of coal.

The two electricity projects under construction in Huainan are Pingwei power plant, where the largest Chinese-made coal-fired generating units are being installed, and Luohe power plant, which is being built right in a coal-mining area.

Hailed as a showcase project, the Pingwei plant is designed to install two sets of domestically-produced 600,000-kilowatt units, made possible by the introduction of American technologies in 1981.

These large-capacity generators are at present being manufactured in China for trial.

The nation's first 600,000-kilowatt unit was commissioned in Pingwei in 1988 and is now running "according to plan," said the ministry official.

The machine depends on high-grade coal transported from the coal fields by a special railway, and electricity is transmitted through the East China power network through 500-kilovolts transmission lines.

Situated in Luohe town, a large coal-producing centre in Huainan, the other plant has a designed capacity of 1.2 million kilowatts, of which half has been installed and is awaiting operation.

Major Breakthrough in Drilling Technology Reported

916B0090C Beijing RENMIN RIBAO in Chinese 4 Aug 91 p 1

[Article by reporters Zhu Wenzhi [2612 2429 1807] and Hou Yanfeng [0186 0917 1496]: "Major Breakthroughs in China's Horizontal Drilling Technology, Single-Well Daily Output About 10 Times Higher than Regular Vertical Wells"]

[Text] The curtain on the Eighth 5-Year Plan has just been opened and China's petroleum industry is singing an even happier song: major breakthroughs have been made in horizontal drilling technology, called the "second revolution" in the petroleum industry.

Petroleum horizontal drilling technology was one of the state's projects to attack key S&T problems during the Eighth 5-Year Plan. This modern high-tech research and experiment project has been taken on by Shengli, Zhongyuan, Huabei [North China], and five other oilfields.

Vertical drilling technology, which is usually used for China's petroleum well drilling, can only reveal a single point in underground oil strata. It takes many vertical exploratory wells to prove the oil-bearing situation of each accumulation strata at enormous expense. In the late 1980's, a few developed nations widely adopted horizontal drilling technology which involved having the drill bit drill in a direction parallel to the ground surface toward a specified objective after reaching a certain depth via vertical drilling. This type of horizontal drilling can pierce several ten oil and gas strata and greatly reduce "dead end" oil regions. It is particularly useful for full extraction of the oil and gas resources of old oilfields, and single-well daily outputs are about 10 times higher than regular vertical wells.

On 13 Jan 91, the Shengli Oilfield Drilling Company drilled its first horizontal exploratory well in an unconformable oil pool in the Chengkou oil deposit. The design and construction of this large-radius horizontal well, called the Chengke-1 well, has a 505 meter-long horizontal section. Interpretation of electrical logging data indicates that the oil strata are 19 strata thick and 211.5 meters long. Daily output of 230 tons of high-output oil flow was obtained, which is equal to the daily output of nine vertical wells in this oil region. Statistics show that the Chengke-1 well has produced a total of more than 20,000 tons of crude oil in the half year since it began operating and that the cost of drilling the well has been completely recovered.

By 22 Jul 91, the Shengli Oilfield Drilling Company had continued with the drilling of the Yong 35-Ping 1 well and Shuiping [Horizontal]-1 well, two moderate-radius horizontal wells. The Yong 35-Ping 1 well is the first moderate radius horizontal well drilled independently by China's petroleum industry. The Shuiping-1 well has a horizontal section 540.98 meters long. Initial interpretation of electrical logging indicates that the oil strata are 22 strata thick and 209 meters long. The length of the horizontal section set a new record in China and exceeded the length of the moderate radius horizontal well segments maintained to date by the United States' three largest oil companies. China is now drilling three moderate radius horizontal wells on a trial basis for the first time in thin oil strata and conglomerate condensed oil regions, where drilling has now begun in Shengli Oilfield. Information indicates that no precedent has been seen for the Cao 20-Ping 1 well, a horizontal well drilled in a conglomerate condensed oil region, in horizontal well drilling data from foreign countries.

Moreover, Zhongyuan Oilfield and Huabei Oilfield each drilled their first horizontal wells over 200 meters long in 1991.

It was revealed by Shengli Oilfield's chief engineer Sun Jiancheng [1327 1696 2052] that noteworthy developments have been made in China's petroleum drilling technology in the past several years. We have successfully experimented with and placed into operation directional wells, clustered wells, super-deep wells, large inclination wells, and other special technique oil wells. The major breakthroughs made in horizontal drilling technology in 1991 are an indicator that China's petroleum drilling control technology has attained advanced world levels.

Major Oil, Natural Gas Discoveries

New Oil Deposits Discovered at Shengli

916B0090B Beijing RENMIN RIBAO HAIWAI BAN in Chinese 7 Aug 91 p 1

[Article by reporters Hou Yanfeng [0186 0917 1496] and Zhu Wenzhi [2612 2429 1807]: "Several Major Discoveries Made in Exploration at Shengli Oilfield"]

[Text] A series of major new discoveries were made in 1991 in petroleum exploration at Shengli Oilfield.

Shi Defu [1597 1795 4395], chief engineer in the Shengli Petroleum Management Bureau revealed that a large oil deposit with reserves of about 50 million tons has been found in the Fanjia region of Gaoqing County, Zibo City, Shandong Province; that 40 million tons of new reserves may be proven in the waters around Chengdao Island in the shallow seas of the Bohai Bay that would increase the geological petroleum reserves of Chengdao deposit to more than 100 million tons, which is another large integral oil deposit whose discovery follows that of the Gudong oil deposit in the 1980's; that another fault-block oil deposit was discovered in the Laohekou region in the eastern part of Chengdong Oilfield; that two wells drilled during 1991 in the Shuangfeng region of Huimin depression both produced oil and may allow the formation of a moderately-sized oilfield; and that the adoption of new prospecting technology by oilfields has led to continual discoveries of concealed oil deposits in old oil regions.

Chief engineer Shi Defu predicts that the newly-proven geological petroleum reserves in Shengli Oilfield during 1991 may exceed 100 million tons.

Shengli Oilfield, located on the Huang He delta, is China's second largest oilfield. This oil deposit was discovered in 1961 and was placed into development in 1964. Shengli Petroleum Management Bureau director Lu Renjie [7120 0086 2638] said that after all of the newly-discovered large integral oil deposits are fully developed, crude oil output from Shengli Oilfield may rise up to a new stage.

Significant Natural Gas Reserves Discovered in Northern Shaanxi

916B0090B Beijing RENMIN RIBAO HAIWAI BAN in Chinese 7 Aug 91 p 1

[Article by reporter Liu Rongqing [0491 2837 1987]: "Natural Gas Reserves of Yulin Region Are China's Champions"]

[Text] Yulin region in Shaanxi, which has already been included as a key exploration project in the Eighth 5-Year Plan, may be assessed as a world super-grade natural gas deposit.

Since 1985, the China Petroleum and Natural Gas Corporation's Changqing Petroleum Exploration Bureau has been doing natural gas prospecting in Zizhou, Suide, and seven other counties in northern Shaanxi and has made gratifying discoveries. It has now been confirmed that an area covering 1,200 square kilometers between Hengshan and Jingbian controls natural gas reserves of 80 billion cubic meters, making it the primary reserve area for natural gas in the Yulin region that covers a large area, has a stable geological structure, contains many gas-bearing strata systems, has high single-well output, and has a low sulfur content and ideal gas quality, with reserves that are China's leader.

Information indicates that the state will invest 1 billion yuan during the Eighth 5-Year Plan to accelerate development of natural gas resources in northern Shaanxi and will build gas transmission pipelines from Zhenchuanbao to Yulin and from Jingbian to Xi'an and other regions, as well as a natural gas chemical plant.

After analyzing and comparing existing data, scientific research departments have stated that Yulin in northern Shaanxi has natural gas reserves in excess of 300 billion cubic meters and extremely gratifying prospects for development and utilization.

Shaanxi-Gansu-Ningxia Basin Becoming Natural Gas Base

916B0090A Shijiazhuang HEBEI RIBAO in Chinese 5 Jun 91 p 4

[Article by reporter Wang Jianping [3769 0256 1627]: "Shaanxi-Gansu- Ningxia Basin To Become China's Natural Gas Production Base Area"]

[Text] Major progress continues to be made in natural gas exploration in the Shaanxi-Gansu-Ningxia Basin. The area will become China's best prospective natural gas production base area.

Beginning in December 1990, nearly 5,000 workers and S&T personnel in the Changqing Petroleum Prospecting Bureau concentrated in the basin's central paleouplift region to conduct large-scale exploration. They have now drilled more than 30 exploratory wells. None of them were dry holes, and gas was found in all of them. Logging indicates that there are 12 wells with daily outputs in excess of 100,000 cubic meters and that there are two wells with post-acidification daily output resistance-free flow rates exceeding 1 million cubic meters, an indication of excellent prospects for a high-output gas bearing region covering a large area.

The Shaanxi-Gansu-Ningxia Basin covers an area of 200,000 square kilometers. The exploration situation provides an initial confirmation that there is a large multi-strata system gas region with compound areas over a substantial range in this region. The gas strata are generally 200 to 3,700 meters deep, the gas is of good quality, and is has extraction value.

Domestic FBR R&D Described, Long-Term Goals Specified

916B0087A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 23 Jun 91 p 2

[Article by Xu Zhu [1776 6899] of the Chinese Academy of Atomic Energy Sciences: "The Future of Fission Nuclear Energy: Fast Neutron Breeder Reactors"]

[Text] On 2 Dec 42, the Italian-American scientist Enrico Fermi led a small group in completing the world's first nuclear reactor and revealed the mystery of the sustained release of fission neutrons and the enormous energy hidden in the fissionable atomic nucleus uranium-235. With this, mankind began to enter the era of nuclear energy and nuclear technology applications.

As for using nuclear energy to generate electric power, by the end of 1989 the world as a whole had 426 nuclear power plant reactors in operation with a total installed generating capacity of 318,271MWe and the electricity they produced in 1989 accounted for 16.7 percent of world electric power output.

Most (98 percent) of these reactors are thermal neutron reactors that mainly utilize the naturally-occurring fissionable isotope uranium-235 as a fission fuel. Uranium-235 accounts for about 0.7 percent of natural uranium, while uranium-238, which accounts for about 99.2 percent of natural uranium, cannot be effectively utilized in thermal neutron reactors. However, it is easily converted into fissionable plutonium-239, plutonium-241, and so on by the absorption of neutrons. In thermal reactors, fewer fissionable nuclei are produced than are consumed, so the plutonium used in reactors is converted. If continued in this manner, developing thermal neutron nuclear power plants theoretically can only utilize 1 to 2 percent of uranium resources.

Fast neutron reactors mainly use fast neutrons to sustain a chain reaction and liquid sodium as a coolant. Moreover, the byproduct of thermal reactors, industrial plutonium, is used to make fissionable fuel (uranium-238 is bombarded with fast neutrons to cause a nuclear reaction that creates plutonium-239). When this type of reactor is operating, more fissionable nuclei are produced than are consumed, so more "burning" produces more fissionable fuel. Thus, they are called fast neutron breeder reactors [FBR]. They actually consume uranium-238 and in principle, except for that which is consumed, the uranium-238 can be converted into plutonium in the FBR and then used.

As thermal reactor nuclear power plants develop, continuing to develop FBR nuclear power plants can increase uranium resource utilization rates to 60 to 70 percent.

The world only has 2.5 million tons of economically extractable uranium resources at present, which is enough to operate existing nuclear power plants for about 60 years. Recovering plutonium for use in thermal reactors as described above to increase resource utilization rates is restricted by the accumulation of long-lived actinium system isotopes, so utilization rates of more than 1 percent are actually difficult to achieve. FBR can use fast neutrons to "burn up" the long-lived actinium system isotopes and a 60 to 70 percent high utilization rate gives extraction value even to rather poor uranium ore. This multiplies the world's extractable uranium resources by 1,000 times. Thus, developing FBR can provide several 10,000 times as much fission nuclear energy from uranium resources compared to simply developing thermal neutron reactor nuclear power plants. How important this is for mankind's material civilization!

It is for precisely this reason that nearly all countries that are developing nuclear power have been concerned with developing FBR. The world has completed about 20 FBR to date and, with the exception of some that have been shut down, 11 are still operating. Three more are under construction and several are planned for construction. These already-built FBR are as small as a few 100 kW to as large as 1,200MWe, and they have developed along a path from experimental reactors, to principle-type reactors, to commercial verification reactors. The largest commercially verified reactor, the 1,200MWe Creys-Malville (Super-Phenix-1), was completed in France in 1985 and provided much experience. In foreign countries, FBR are already on the eve of commercial use.

China began developing FBR technology in the mid- and late 1960's. We concentrated definite manpower and materials and began basic research in FBR neutron physics, thermohydraulics, sodium technology, FBR materials, and other special fields. We established over 10 small sodium loop and experimental devices including a fast neutron zero-power device for which Premier Zhou Enlai personally approved the transfer of 50 kg of uranium-235. We used the establishment of these devices and research work to train several FBR technical personnel.

Beginning in 1988, FBR became one of the advanced nuclear reactor types in the energy resource field and technical development work on it was included in China's high-tech development plans. We began FBR design research and single- item research focused on sodium technology, fuel and materials, and FBR safety and, under the leadership of the China Nuclear Industry Corporation (formerly the Ministry of Nuclear Industry), we began making preparations for an FBR engineering development laboratory.

On the basis of research on China's FBR development strategies, two conclusions can be drawn:

1. We should develop as many pressurized-water reactors [PWR] as quickly as we can to provide initial loads for FBR. Given the economic requirements of FBR, the initial loads of commercial FBR should use the industrial plutonium byproducts from thermal reactor nuclear power plants. Thus, on the basis of research on optimum scales for uranium and plutonium cycling and post- processing, we should develop as many PWR nuclear power plants as quickly as we can to prepare initial loads for FBR.

2. China should develop FBR in three steps, focus on safe and economical FBR engineering technology, and prepare for major development of FBR.

Step 1, envisaged as the completion of China's first FBR 20MWe experimental reactor by the end of this century. Its conceptual design research and scientific research in the related specializations are now being completed in the single-topic research work on high-tech FBR described above. To support the design of this experimental reactor, which will involve sodium technology and heat engineering and safety, as well as engineering loops and components engineering and development laboratories, ground was broken in November 1990 at the Chinese Atomic Energy Scientific Research Academy for the first phase of the FBR Research Center project.

Step 2, envisaged as the completion of economically acceptable modular FBR assembly power plants with good safety characteristics by the year 2015 and their extension.

Step 3, envisaged as the completion of safe and economical large reactors with high breeder capacities by the year 2025 and their extension. Based on fuel technology now being developed in the United States, there is hope that a fuel multiplication time period of 6 to 7 years can be attained, meaning that the nuclear power capacity could grow at the rapid rate of doubling within 10 years.

China began developing nuclear power relatively late. The 2 x 900MWe Daya Bay Nuclear Power Plant and 300MWe Qinshan Nuclear Power Plant are nearing completion, and China's total electric power production capacity exceeds 130,000MWe. It can be expected that by the early 21st Century, nuclear power in China, in which PWR are the main force, will play an important role as a supplement and substitute energy resource in regions with electric power shortages. From the early 21st Century through the 2050's, replacement and development of FBR will lead to nuclear power playing a major role in China's electric power production. By the 2070's to 2080's, with the rapid breeding of FBR fuel, our nuclear power capacity will grow quickly and China's nuclear power will play a major role in China's electric power production.

Developing FBR, the future of fission nuclear power, gives us ample time to welcome the arrival of the era of using inexhaustible fission nuclear energy.

[Photo caption]: An FBR mockup developed by relevant personnel in the China Atomic Energy Sciences Research Academy on display at the recent "863" Achievements Exhibition.

Pressure-Vessel Design for Qinshan NPP-1 Fuel Assembly Scouring Tests

916B0087B Beijing HE DONGLI GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese Vol 12, No 3, Jun 91 pp 1-6

[Article by Gan Jianheng [3927 1696 5899], Wang Songfeng [3769 2646 1496], Zhang Fuyuan [1728 1381 3293], Zhan Kechun [6124 0668 4783], and Yang Xiang [2799 3276] of the China Nuclear Power Research and Design Academy, Chengdu: "Design for a Fuel Element Scouring Test Pressure Vessel"; initial manuscript received 19 Apr 90, revised manuscript received 25 Jan 91]

[Text] Abstract: This article describes the design of a pressure vessel for high-temperature, high-pressure scouring tests of 1:1 fuel assemblies for the first-phase project at Qinshan Nuclear Power Plant. The main aspects of this equipment are: stepless adjustable off-centering, elastic support, use in cross scouring tests, and use in scouring tests of full-size fuel assemblies for 600MW, 900MW, and 1,200MW nuclear power plants.

Key terms: fuel assemblies, cross scouring, adjustable off-centering, elastic support, pressure vessel.

I. Introduction

According to provisions from the State Nuclear Safety Bureau and other state nuclear safety departments, newly designed and manufactured fuel assemblies, drive mechanisms, and so on must undergo 1:1 hot-state kinetic scouring tests outside the reactor. The test results must be reported to the State Nuclear Safety Bureau for inspection and evaluation, and only after approval can a nuclear power plant be loaded and started up.

To meet China's need to develop nuclear power, we began designing a key piece of equipment for the scouring test platform, a fuel assembly scouring test pressure vessel (abbreviated below as the vessel), in 1987.

The operating temperature and pressure of this vessel are about the same as those of an actual reactor pressure vessel but there are major structural differences. This vessel contains one fuel assembly and control rod assembly (including drive shaft), guide tube assembly, and corresponding supporting and holddown mechanisms. A magnetic lifting control rod drive mechanism is installed on the top (Figure 1). With the exception of the fuel assembly cores, all of these components are identical to the components and products used in an actual reactor. Thus, this vessel is actually a mockup of a reactor pressure vessel that is used solely to conduct hot-state kinetic scouring tests of fuel assemblies outside a reactor.

This vessel was used for the first time to conduct hot-state kinetic scouring tests outside the reactor of the fuel assemblies for the 300MW reactor in the first phase of the Qinshan Nuclear Power Plant in March 1990, and they have now been completed.

II. Design Objectives

After completing scouring tests on the fuel assemblies for the 300MW reactor at Qinshan Nuclear Power Plant, the fuel assembly scouring test platform can also be used to conduct scouring tests on fuel assemblies for even higher-power reactors and for cross-current scouring tests. The main design data for this vessel are given in Table 1.

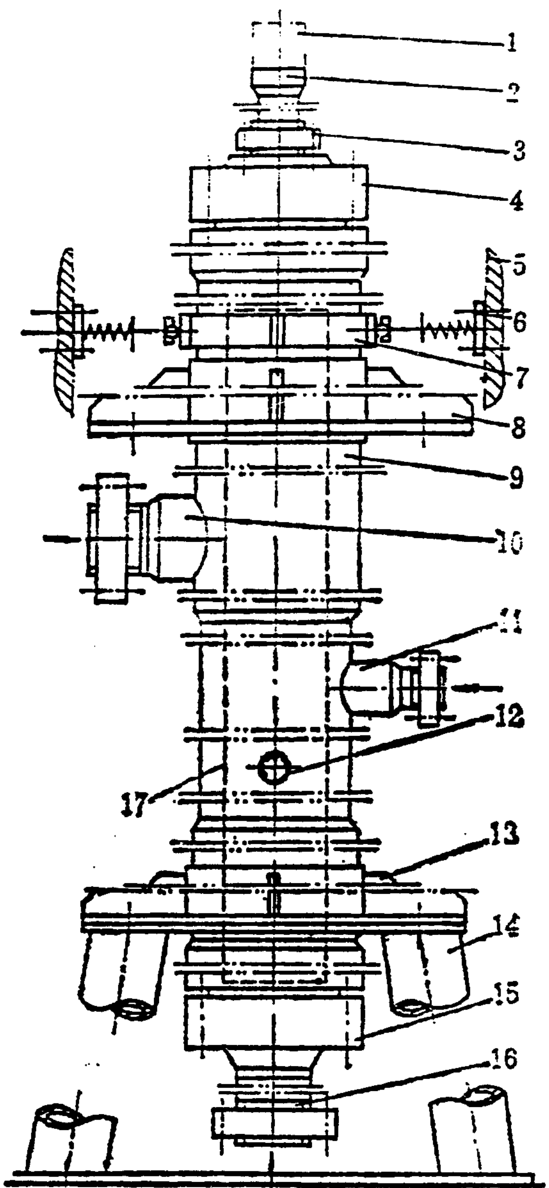

Figure 1. Structural Diagram of the Fuel Assembly Scouring Test Pressure Vessel

Key: 1. Drive mechanism; 2. Pipe holder; 3. Threaded flange; 4. Top cap; 5. Steel framework; 6. Side supports; 7. Clamp; 8. Pedestal; 9. Tube part; 10. Outlet connecting pipe; 11. Cross scouring pipe; 12. Lead wire connecting pipe; 13. Pedestal; 14. Pedestal frame; 15. Bottom cap; 16. Inlet connecting pipe; 17. Guide tube assembly, control rod assembly, fuel assembly and other internal parts

Table 1. Main Design Data

Name	Value
Working medium	Deionized water
Working temperature, °C	325
Working pressure, MPa	15.5
Earthquake resistance design strength, magnitude	7
Inner diameter of vessel tube, mm	425
Net height of inner cavity of vessel, mm	approx. 10,000
Precision of drive line starting point centering, mm	≤ 0.6
Off-centerness, mm	0 to 15
Useful lifespan, years	20

III. Brief Description of Design

Based on the "Pressure Vessel Safety Supervision Regulations" issued by the former State Central Labor Bureau, this vessel was a high-temperature, high- pressure category 3 pressure vessel that was designed mainly in accordance with the "Design Provisions for Steel Petrochemical Pressure Vessels" published by the "National Pressure Vessel Standardization Technical Commission".

A. Primary materials

Corrosion-resistant austenitic stainless steel with good weldability properties was used for the parts of this vessel that come into contact with the working medium. The material used for the tube, top cap, off-center drive pipe holder (abbreviated below as the pipe holder), bottom cap, connecting pipes, and other pressure-bearing components was 1Cr18Ni9Ti (JB-755-85) and the actual production forged hardware was made of 0Cr18Ni9Ti (carbon content 0.06 percent).

B. Overall design of vessel

This vessel is an upright cylindrical tube. The working medium flows in from the inlet connecting pipe at the bottom and flows out of the outlet connecting pipe near the top of the tube. During cross scouring tests, the lateral flow enters via the cross scouring connecting pipe in the middle of the tube (see Figure 1). The deionized water circulates in a closed loop with the aid of a pump. There are corrugated pipe expansion joints at the lower end of the internal parts inside the tube and the lower end maintains contact with the surface of the groove on the lower seal to prevent leakage of the fluid. A flange, guide tube assembly, and other internal components are suspended inside the tube 698 mm from the top end of the tube along with four block keys (welded during installation of the unit), a compression tube, and so on that are used to adjust and fix the centering. The assembly and connection of the pipe holder

at the top of the vessel to the magnetic lifting control rod drive mechanism is identical to the pressure vessel of an actual reactor. After overall assembly, the exterior of the vessel is wrapped in a layer of microporous calcium silicate insulation.

This vessel is composed of a pipe holder, top cap, tube, lower seal components, main and auxiliary supports, seals, fasteners, and other parts and components. Bipyramid seals with identical structural dimensions are used at both ends of the tube and between the top cap and lower seal. The bipyramid gaskets are made from annealed red copper and are punched from a solid copper slab. The surfaces are silver-plated to increase the affinity between the gaskets and the adjacent components. A solid metallic flat gasket structure is used between the pipe holder and top cap. Lens-shaped seals are used between all of the connecting pipe mouthpieces and the external piping. The seating surfaces of the seals are all buttered with a nickel-based alloy to increase the hardness of the seating surfaces of these seals (buttered layer $H_B \approx 150$) and to avoid the relatively low hardness values due to the parent material and the lens-shaped gaskets (for the 0Cr18Ni9Ti forged hardware, the measured value was $H_B \approx 150$) and the problem of possible hard-to-repair damage to the seating surfaces due to being removed and installed several times during the installation and utilization process. The material for the main bolts was 40CrNiMo. The primary design parameters are given in Table 2.

Table 2. Primary Design Parameters

Name	Value
Design temperature, °C	350
Design pressure, MPa	17.2
Hydraulic testing pressure, MPa	27.6
Internal diameter of inlet and outlet connecting pipes, mm	178
Internal diameter of cross scouring connecting pipes, mm	100
Diameter of instrument lead wire connecting pipes, mm	50
Inner diameter of tube, mm	425
Minimum wall thickness of tube, mm	65
Internal/external diameter of both ends of tube, mm	455/685
Length of tube, mm	10,050
Nominal diameter of main bolts, mm	M52x3
Thickness of top and bottom caps, mm	200
Total height of vessel, mm	approx. 12,250
Total volume, m^3	approx. 1.45
Total weight, kg	approx. 18,000
Pressure vessel category	Category 3

C. Design of Tube

The tube is one of the main components. It is composed of the tube, outlet pipe, cross scouring connecting pipe, instrument wire lead connecting pipe, and pedestal gaskets (1Cr18Ni9Ti) welded together. There were two tube design programs, integral forging or welding of three tube segments. Eventually, the processing plant attacked key technical problems and was able to forge it in one piece. In this way, the finished 10,050 mm-long tube did not have circular welding seams, which reduced the amount of welding and other work and significantly shortened the manufacturing schedule. It also helped guarantee the quality of this product. Saddle connecting pipe structures were used for all three of the connecting pipe mouthpieces on the tube. To ensure the quality of the welds for the connecting pipes, measures were adopted for pre- welding leeway and post-welding processing to remove the welding rods. After the tube, connecting pipes, and pedestal gaskets were welded together, the entire unit again underwent precision processing to ensure the rather high precision demanded in the design.

D. Adjustable off-centering mechanism design

Given the special applications need for artificial adjustment of off- centerness during the tests, we applied eccentric rotation principles and designed a mechanism shown in Figure 2 that can be used for stepless adjustment of off-centerness from 0 to 15 mm. The exterior threaded section at the bottom of the pipe holder (equivalent to the drive mechanism pipe holder in the pressure vessel of an actual reactor) and the axial line O of the φ145 outside cylinder surface section beneath it that is inserted into the top cap (abbreviated as the off-center axial line) are off-center from the pipe holder's φ passageway hole axial line A (also the central axial line B of the top cap or tube, abbreviated as the main axial line). The nominal off-centering distance is one-half the maximum off-centerness, that is 7.5 mm. Similarly, the pipe holder insertion hole on the top cap is also a φ145 off- center passageway hole. The nominal off-centering distance of its axial line from the main axial line is also 7.5 mm. There is a movable fit (φ145H8/e7) between the pipe holder and top cap. The exterior threaded section of the pipe holder is fitted with a threaded flange, and bolts and so on are used to connect the pipe holder to the top cap. The pipe holder is fitted with a removable and adjustable pointer frame and there is a corresponding angle dial on the top cap. The pointer indicates the rotational position of the pipe holder relative to the top cap.

During installation, the main axial lines of the pipe holder and the top cap are centered (that is, the A and B axial lines are made to coincide; prior to this, an optical instrument is used to align the main axial lines of the top cap and the tube and an assembly/disassembly reset device is installed). At this time, with the nominal off-centerness being zero, this is "theoretical zero centering" (Figure 2a). During use, the pipe holder and the components above it are raised to a certain height and it is re-rotated around the eccentric axial line O to make the main axial line A of the pipe holder (which is the same as the axial line of the drive mechanism) off-center from the main axial line B of the tube. The distance AB between the two as shown in Figure 2b is the off-centerness. The actual off-centerness is

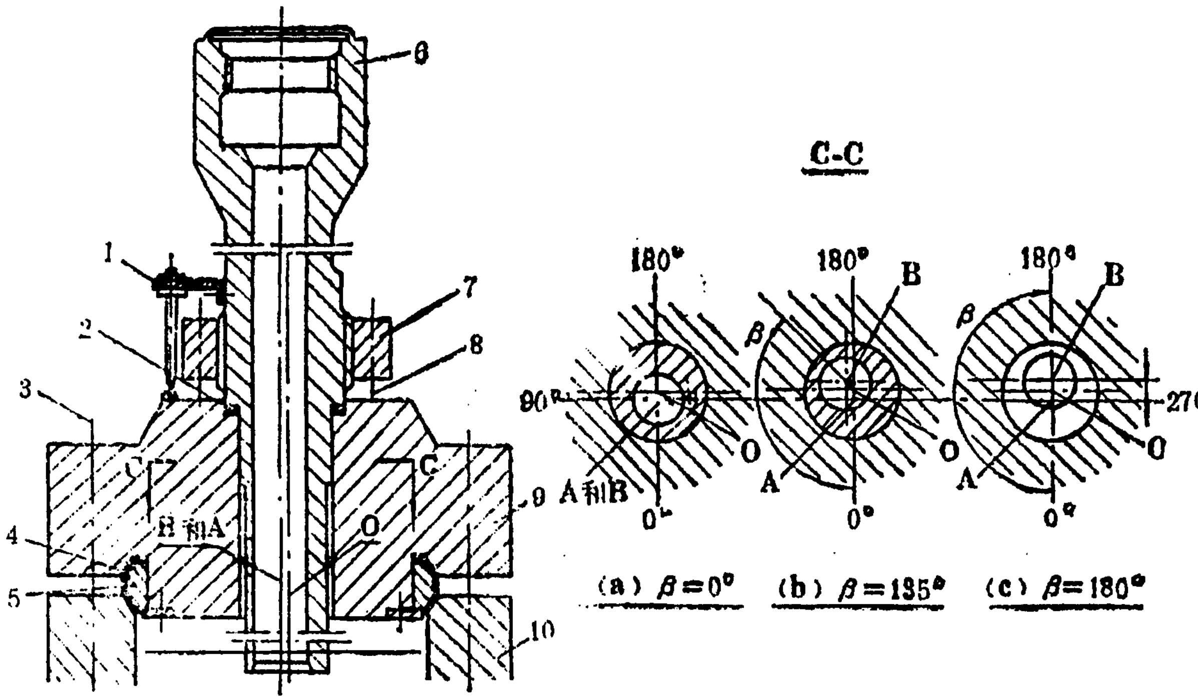

Figure 2. Principles and Structural Diagram of Adjustable Off-Centering

Key:1. Pointer frame; 2. Gasket; 3. Dual-head bold; 4. Bipyramid gasket; 5. Bipyramid ring; 6. Eccentric drive pipe holder; 7. Threaded flange; 8. Dual-head bold; 9. Top cap; 10. Tube; C. Eccentric axial line; A. Main axial line; B. Axial line of pipe holder φ passage hole; β. Rotation angle of pipe holder relative to top cap; AB. Off-centerness

selected and adjusted according to experimental requirements. Theoretically, the maximum off- centerness by rotation to a position 180° from "zero centering" in any one direction is 15 mm (Figure 2c).

E. Main and auxiliary support design

After overall installation on-site, the vessel with its drive mechanism is 16.2 m tall, and it must satisfy the requirements of prior and subsequent installation at different locations. Thus, we designed the main and auxiliary support structures shown in Figure 1.

During the first installation and use, the circular hanger support welded to the bottom of the tube and the pyramid-shaped support frame welded to the base served as the main supports. The removable clamping hoops at the top of the tube and the elastic supports on the side were used as auxiliary supports. When installing and using in a different location, the circular hanger support at the top of the tube is used as the main support and the auxiliary supports are installed near the bottom of the tube. This avoids the problems of having to redesign the supports and re-weld the pressure-bearing components of the vessel for installation at a different location and changes in installation conditions.

When conducting hot-state kinetic water lowered-rod tests, the magnetic lifting drive mechanism has rather substantial shock and vibration effects on the vessel. This is particularly true for the steel framework that holds the vessel's auxiliary supports. It is about 30 m high and is a closed operating platform. It is not sufficiently rigid and the effects of wind loading, earthquake loading, and other dynamic loading can create rather substantial lateral bending and rocking of the vessel and in turn cause the shock load to affect the vessel. This a rather unique engineering reality problem encountered during the design. Using regular auxiliary support caps and guide devices commonly used on upright equipment is not feasible. Thus, consideration must be given to convenience in installation, the functions of the guides and supports, and so on to leave a specific gap between the equipment and the support caps and guide devices. This caused the vessel to rock due to the effects of the drive mechanism during the tests. When subjected to earthquake loading, rigid collision may occur between the vessel and the steel framework. Thus, elastic supports as shown in Figure 3 were designed as auxiliary supports.

The elastic components are a group of seven identical cylindrical compressed springs in a concentric configuration. The group of springs was designed on the basis of the horizontal seismic shock on the vessel (including the drive mechanism installed at its top) during a magnitude-7

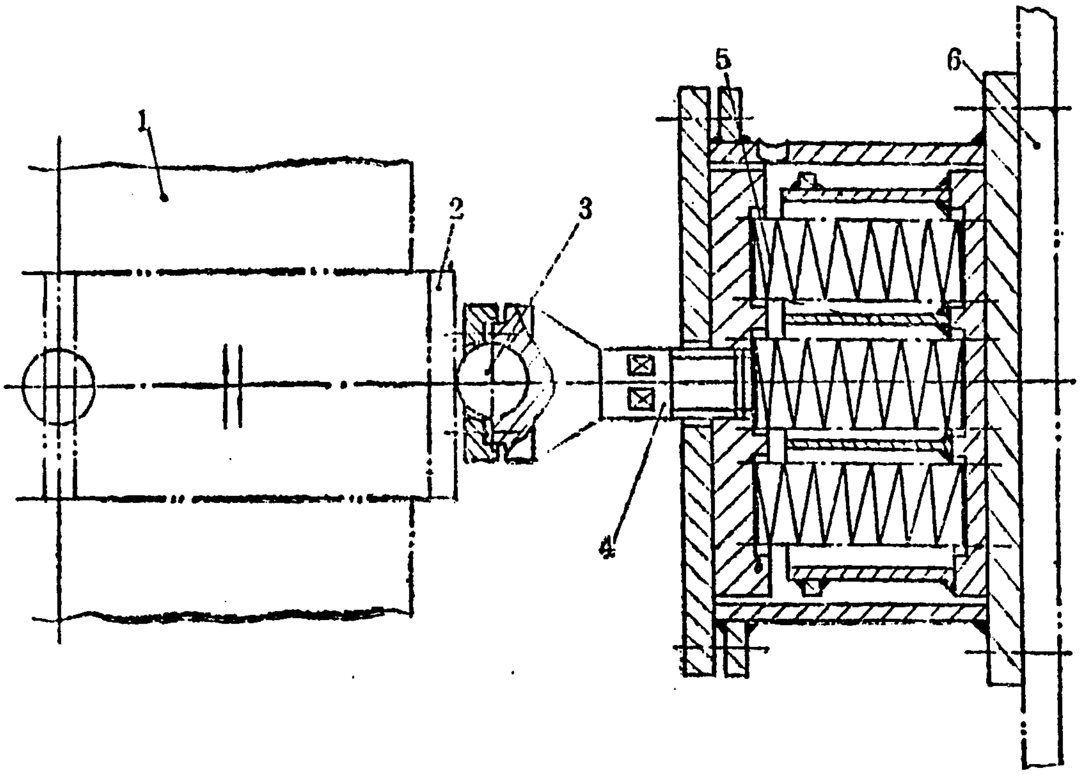

Figure 3. Diagram of Elastic Auxiliary Supports

Key: 1. Scouring vessel tube; 2. Clamping hoop; 3. Steel ball; 4. Side support; 5. Spring group; 6. Steel framework

earthquake. The maximum operating travel of the spring group is the lateral displacement of the vessel at the location of the auxiliary support cross-section under the effects of the seismic force. Horizontal earthquake loading is dynamic loading and the direction of its action is arbitrary. Thus, there are steel balls capable of arbitrary movement at the ends of the side supports and the side supports come into contact with the clamping hoops through the steel balls. In this way, after installation and adjustment, the elastic force is created by the precompression displacement of the spring group and the four side supports placed evenly around the circumference serve as stable radial supports for the vessel. When conducting rod lowering tests, the vessel does not wobble from the effects of the shock from the drive mechanism. Temperature rise or temperature drop processes in the vessel can also cause free vertical displacement of the vessel upward or downward. While there are just four side supports, the arbitrary rotation of the steel balls means that when there are horizontal seismic shock forces or other accidental shock loading on the vessel from any direction, the side supports are always capable of buffering the shock force received by the vessel and supporting it, and the position check blocks in them restrict the vessel from lateral rocking and displacement in excess of its design allowances and prevent local instability and destruction of the vessel.

IV. Design Characteristics

A. High utilization rate

If the design was prepared only for the fuel assemblies of the 300MW reactor at Qinshan Nuclear Power Plant, the tube of this vessel would only have to be 5 to 6 m long. With an eye to development and through further consideration, and based on the need for development in the direction of larger scales and a shift to domestic production in China, the tube was lengthened appropriately on the basis of the original considerations. This meant that after completion of the 300MW reactor fuel assembly tests, simply changing some of the internal support and hold-down components based on the structural dimensions of the fuel assemblies to be tested could permit its use for scouring tests on fuel assemblies for 600MW, 900MW, 1,200MW, and even larger reactor powers, which significantly increases the utilization rate of the vessel.

B. Lateral flow scouring test research functions

None of China's previous experiments in testing drive line cold state centering had cross scouring test functions. This requirement was not taken into consideration in the initial design for this vessel. However, several foreign countries with relatively advanced similar testing technology have

begun doing experimental research on the effects of cross-flow scouring. Undertaking this type of research in China was also essential. Thus, based on the conclusions of debates by relevant experts, we immediately added the relevant designs in the design to give this vessel the functions required for conducting experimental research in the area of the effects of cross-flow scouring. This gave the vessel more complete functions.

C. Capability of stepless adjustment of off-centering from 0 to 15 mm

The sealing design for high-temperature, high-pressure vessels is an important question. For this reason, we successfully used a rotating eccentric drive pipe holder in this high-temperature, high-pressure vessel to make a structure capable of stepless adjustment of off-centerness from 0 to 15 mm. In this manner, although we only installed one drive line, the selection of different amounts of off-centering to conduct tests enables us to conduct centering simulation tests on various drive lines with different off-centerness in a reactor. This design provided a good solution to the problem of needing to guarantee the sealing properties of high-temperature, high-pressure vessels while also making it easier to adjust the off-centerness (with a non-moving top cap).

D. Unique elastic auxiliary supports

The design of the supports for this vessel took into consideration actual installation and utilization conditions and satisfied the requirement for a one-time design and different prior and subsequent uses when installed at different locations. The design of the elastic auxiliary supports is structurally simple, tight, and useable.

E. Good sealing properties

This vessel is a high-temperature, high-pressure vessel with greater complexity, uniqueness, and installation precision than the structure of regular high-temperature, high-pressure vessels. Practice in manufacturing, inspection, installation, debugging, and actual use showed that it had rather high installation precision and good sealing properties, and was safe and reliable.

V. Conclusion

In summary, this is the first large high-temperature, high-pressure vessel studied, designed, and manufactured in China for the special purpose of conducting hot-state kinetic water scouring tests on fuel assemblies. It has rather unique characteristics and completely satisfies all design requirements. Its successful development has satisfied China's urgent need for conducting hot-state kinetic water scouring tests outside the reactor for the fuel assemblies of the 300MW reactor in the first phase of Qinshan Nuclear Power Plant which were designed and manufactured by China herself. It conserved foreign exchange outlays for the state and also provided a large-scale experimental facility that China must have for a shift to domestic production and larger scales in nuclear power, so it has rather substantial social benefits.

Wind Power Field Goes Into Operation

916B0088D Beijing ZHONGGUO KEXUE BAO in Chinese 26 Jul 91 p 2

[Article by special reporter Zhao Xiaomei [6392 2556 2734]: "Sijiao Wind Power Generating Field Goes Into Operation"]

[Text] The Sijiao wind power generating field, built cooperatively by China and Germany, recently completed installation in Zhejiang's Shengsi County and began operating.

Shengsi County, Zhejiang Province is located on the Shengsi Archipelago on the northernmost side of the East China Sea's Danshan Archipelago and is surrounded by the sea. The average annual wind speed on the island is 7.4 meters/second and it has an annual effective wind time of 7,723 hours, so it is one of China's leaders in wind power resources.

The just-completed wind power generating field is located at Tianlaigang on Sijiao Island. It was a cooperative scientific and technical project of the State Science and Technology Commission and the German Ministry of Science and Technology. Germany provided ten 30 kW wind-powered generators at no cost along with the auxiliary equipment. The State Planning Commission, Chinese Academy of Sciences, and Zhejiang Provincial Planning Commission provided matching funding support. The implementing unit was the Chinese Academy of Sciences Electrical Engineering Institute. After conducting a detailed survey of China's wind power resources, they selected a site for the field in conjunction with German experts. With full cooperation from Shengsi County, Chinese and German engineering and technical personnel took just over one-half month to complete the installation tasks for the 10 generators.

This wind power generating field has a total installed generating capacity of 300 kW. The wind generator towers are 15 meters tall and are composed of a rotor and two blades 12.5 meters in diameter. The startup wind speed of the generators is 4 meters/second and they can reach their rated power output when the wind speed reaches 11.8 meters/second. They will generate a projected 840,000 kWh of power a year. The German experts said that these generators are highly efficient devices for converting wind energy into electricity. They employ automatic tracking of wind direction, hydraulic control, power grid monitoring, resonance protection, and other advanced technologies.

Zhang Shouyuan [8022 0649 0337], director of the New Energy Resource Research Office in the Chinese Academy of Sciences Electrical Engineering Institute, said that China is the world leader in total number of installed wind power generators but over 99 percent of them are miniature 100 W-grade wind-powered generators. Completion of Sijiao wind power generating field provides an excellent demonstration of the development of wind-powered electricity generation in China from single generators to wind-powered generating fields.

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